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To add life to years, not just years to life

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JOURNAL OF GERONTOLOGY

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Gerontology

LAWRENCE K. FRANK

TO MEET THE MAJOR PROBLEM IN OUR SOCIETY OF PREVENTING UNNECESSARY WASTAGE OF HUMAN RESOURCES AND TO INCREASE HUMAN CONSERVATION, THERE HAS BEEN A GROWING INTEREST IN GERIATRICS, THE NEW MEDICAL SPECIALTY FOR THE AGED. IN CONTRAST TO OUR PRESENT MISUSE AND NEGLECT OF OLDER PEOPLE, WE NEED NOT ONLY A COMPREHENSIVE, NATION-WIDE POLICY, BUT MORE INDIVIDUAL AND SPECIFIC TREATMENT.

FOR ALL PROBLEMS OF AGING WE MUST HAVE MORE RESEARCH, MORE EXPLORATIONS IN HEALTH CARE, MORE GUIDANCE FOR THE AGED; AND WE MUST INCORPORATE THIS KNOWLEDGE INTO OUR VARIOUS ORGANIZATIONS AND SERVICES TO PROTECT AND CONSERVE ALL MEMBERS OF SOCIETY.

THE PUBLICATION of the JOURNAL OF GERONTOLOGY as the official Journal of the newly organized Gerontological Society is significant of several recent scientific developments and of ongoing changes in our social and cultural life.

For several years we have been hearing ever more frequently of geriatrics, the new medical specialty for the aged, like pediatrics for infants and children. Likewise, in the various scientific journals we have been reading reports of the study of the aged and of aging, as revealed in different organ systems, tissues, functions, and pathology. More recently there have been studies of mental and personality changes in the aged, together with discussions of the rapid trend toward an older population with all the ramifying political, economic, social, and other implications and consequences of such a shift (1).

Gerontology emerges today as a response to these scientific needs and opportunities and these social responsibilities. It is not just one more highly specialized discipline, the latest addition to the already long and ever lengthening list of "ologies" that make up the academic roster. Nor is it merely an applied science, like much of engineering and technology, which takes over and utilizes the basic research of others. Gerontology reflects the recognition of a new kind of problem that will increasingly command the interest and devotion of a variety of scientists, scholars, and professional workers, all of whom are needed to study such problems as human growth, development and aging, ecology and regional planning, mental hygiene, human conservation, or cultural change. These are multi-dimensional problems which require the pooled efforts of many different disciplines and professions to make the varied observations, to collect the diverse materials, and to carry out the complicated practices for the adequate study of such complex, multi-dimensional processes, events, organisms, situations, and their treatment. These new problems transcend the knowledge and methods of any one discipline or profession and demand the focussing of the findings of many separate investigators into a synthesized, coherent whole.

Gerontology resembles clinical medicine where the physician, in order to diagnose or treat the individual patient, utilizes the concepts, the methods and techniques, and

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the findings of all the medical and biological sciences. Today he is increasingly turning to the psychological and social sciences to help him understand the patient's personality and emotions and his social and family environment (2).

Gerontology, like clinical medicine, must recognize man as a biological organism, with an internal environment of organ systems, tissues and fluids, and functional processes, who exists with other organisms in the geographical space of nature, exposed to all the ongoing physical, chemical, and biological events, to gravitation, barometric pressures, heat, cold, and infections, dependent upon a continuous intake of air, and food for survival, while living in a cultural and social world (3). The conception of a mammalian organism growing, developing, and aging through time while undergoing the interaction with internal and external environments is central to medicine and to gerontology. Both recognize that each individual is a highly idiomatic organism-personality, with a life experience and all the hopes and fears, the memories and expectations that are as much a functioning part of the man as his organ systems and functional activities.

The emergence of these multi-dimensional problems is fostering the rise of cross-disciplinary organizations, such as the Gerontological Society,[1] through which each of the highly specialized investigators may come into professional contact with investigators from other disciplines who are also studying the problem of aging and of the aged. To encompass the complexities and the diverse manifestations of aging, the investigator obviously must rely upon the contributions of many other students of the problem or be guided in his approach by the developing body of knowledge and of new concepts coming from other students of gerontology. Thus, it may be said that gerontology, while dependent upon these many and often highly specialized investigations, looks to a synoptic or holistic correlation of many diverse findings to provide an adequate conception of aging.

Moreover, since aging is a process, a dynamic ongoing activity occurring in time, it presents some challenging questions of scientific methodology and of conceptual formulation which cannot be ignored by those seeking a larger grasp of aging, as exhibited not only in man, but in other organisms, including plant life and even in physical, chemical, and geological complexes (such as the aging of colloids). Indeed, it may be said that the study of aging poses some of the most perplexing questions of our time as we move from an earlier climate of opinion toward the emerging new climate of opinion wherein the biological, medical, and social sciences will sooner or later undergo much the same transformation of concepts and methodologies as in physics with the coming of relativity, of space-time, and field theory.

Likewise, it is evident that the accelerated aging of our population, with a growing proportion of men and women over fifty, also presents problems of large urgency. For this we lack the knowledge and understanding that is necessary for wise and effective action addressed to individuals and to social life.

Since all living organisms exist in space and time and pass through a sequence of changes from their inception to their dissolution, aging is a broad biological prob-

[1] The Society for Research in Child Development is also a cross-disciplinary association of investigators from different disciplines and professions, all of whom are concerned with problems of child growth and development.

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lem. But the kind, the rate, and the expression of aging differ among organisms; some plants, protozoa and insects, for example, do not exhibit the familiar picture of senescence. Thus, no general theory of aging for all organisms can at present be formulated.

In the mammalian species, however, the problem of aging appears in all its baffling complexity. There appears to be an orderly, regular sequence of growth, development, maturation, aging, and senescence, like a broad highway, from conception to death, along which each individual must travel in and through time. But, it is evident that each one will pass along that highway and traverse those sequential changes at his own individual rate of progression and will attain dimensions of size, shape, weight and functional capacities and behavioral adjustments, including those of involution and senescence, which are uniquely his own. Some, of course, due to accident, disease, and other adverse events or circumstances, will die prematurely at different stages in the life sequence.

Initially, it is important to remember that chronological age has a different significance for different individuals. At different periods in the life of the same organism, time may flow at different biological and psychological rates. Or, to use the previous figure of speech, it might be said that at different ages individuals will have travelled different distances along the life career, thereby indicating that biological and physiological time differ from sideral or calendar time (4). It is customary to think of time as a variable or as a frame of reference to which we order our observations; but time may be conceived as a process, as exhibited in the aging of colloids or of wine and perhaps subject to some degree of control. Biology and medicine have not yet fully examined the implications of space-time for their investigations, which might undergo a considerable reorientation from acceptance of this recently developed concept that challenges the customary dichotomy of structure versus function (5).

While statistically the growth curve or life cycle may appear as uniformly and regularly inflected, that smooth curve often obscures the wide variations, and often extreme deviations exhibited by some individuals within the statistical array. As Krogman points out,

> Time has no constant value in growth and development; there are "spring up" and "fill out" periods; there are spurts of rapid growth, phases of slow progress. But the major theme is one of integration so that spring up and fill out, spurt and slow phase alternate rhythmically to produce balance and at least an attempt toward attainment of an optimum. It is to be remembered that perfection may be the standard but adequacy is the goal (6).

This point will bear elaboration. Customarily we group organisms, especially human, according to their chronological age. The most frequent structural and functional changes exhibited by the majority of those in each age group are then considered as norms for each age period. These findings have provided invaluable indications of the changes and especially the pathological transformations which appear with advancing years, but they cannot be accepted as satisfactory answers to the problem of aging, however valid methodologically and statistically.

Clinical records support the common observation of the extraordinary variations among individuals of the same chronological age. Some individuals of advanced years are still vigorous and functionally adequate, showing few or none of the "normal" signs of enfeeblement or impairment, nor do they, at autopsy, show the pathological breakdowns that are statistically established for their age. Contrariwise, some individuals at early adult life are prematurely aged as contrasted with their contemporaries.

It is becoming increasingly evident that the interpretation of the frequent tissue changes found in the aged organism as normal products of aging calls for some further reflection. Men and women come to senescence after a life time of varied experiences, having suffered from the many deficien-

cies, insufficiencies, and vicissitudes of early care and nurture. They have been subjected to infections, injuries, stresses and strains, inadequate or neglected convalescence, plus all the "slings and arrows of outrageous fortune." How much can these degenerative changes be considered as normal aging and how much should they be viewed as evidence of attempted repair or organic adaptation to adverse and threatening events of life? But the question presses for clarification, especially in the light of experimental studies which indicate that "optimum" conditions may produce enhanced vitality and increased longevity, as contrasted with controls that resemble our random sampling of human material.

There is need for a critical reexamination of all the accepted criteria of aging as a threshold task for gerontology. It is especially important to study those subtle, sub-clinical changes that precede the more familiar evidences of pathological alterations and functional failures since these may be the forerunners of aged tissues. The differential impact of aging upon different organ systems reminds us that aging cannot be ascribed to any single organ system or any one structural or functional failure. Despite the passage of years, some organ systems and tissues retain their capacity for continued existence longer than that of the organism itself. Moreover, there is some evidence to suggest that the phylogenetically younger tissues may be more vulnerable to the passage of time than are the phylogenetically older tissues.

Thus there are today two conflictng views of aging, especially in man. One conception is that of an involutionary process, largely pathological, which cumulatively produces inevitable changes in structures and functions, in tissues, cells, and fluids. The contrasting conception is of an ongoing process which is *not* to be confused with the degenerative breakdowns observed in the aged but rather is to be conceived as a process of biological transformation, the nature and operation of which has scarcely been realized because so largely obscured by the pathological changes revealed in tissues and fluids. The confusion has been increased by the recognition of how some of these structural and functional changes appear to be conservative or protective adaptations of the organism in its attempt to maintain itself against various threats and deprivations.

These questions, of large theoretical import, indicate that we are still on the threshold of the problem of aging and must await further intensive investigations to bring some resolution of these seemingly contradictory findings and implications. There is a pressing need for more experimental attacks upon the problem of aging because the further piling up of clinical findings and of pathological observations, however valuable as landmarks and indicators, will not settle the basic issue of what the aging *process* involves.

These observed changes in the aged organism may be viewed as *products* of the *process* of aging, or possibly of other processes that should be distinguished from aging, especially since the late or terminal changes in cells, tissues, and fluids cannot be unquestionably accepted as signs of primary senescence. These observed atrophies and degenerations may be secondary responses to prior alterations in body fluids, especially in the blood, which may have failed to provide adequate oxygen and other nutritive requirements or been unable to maintain the delicately poised and ever changing chemical equilibrium of the intra- and intercellular environments where many of the basic living processes apparently take place.

The process of aging may operate to produce both these secondary changes and also these primary or antecedent alterations and failures. Only experimental studies can hope to reveal what actually takes place in the process of aging and thereby help to identify what is primary and what is secondary, or even more remote consequences of aging.

For such experimental attacks it will be

necessary to make a further distinction. Aging, it will be recalled, is not limited to the older organism. Indeed, as Minot pointed out and as other investigators have been showing, the aging *process* is operating early in life and sometimes most rapidly in infantile or juvenile organisms and in the fetus. Moreover, some of the most accessible cyclical processes of the adult mammalian organism involve aging, as shown by the monthly growth, maturation, and involution of the ovarian follicle and of the endometrium and also in the development and aging of the placenta.

Even more challenging for investigation are the varied processes of aging exhibited in different cells of the organism. Each has its life span, as shown by the short-lived blood cells which are produced and eliminated in prodigious numbers daily and the cells of other tissues and organs which are replaced at different rates or frequencies. Indeed, with the exception of the central nervous system (the cells of which apparently are not replaceable), there is a continuous process of aging and replacement of cells throughout the living organism. An adequate conception of aging and a systematic investigation of the aging process must embrace these cellular replacements and attempt to show how they take place through the operation of living processes in growth and development and aging.

But today we must realize that the study of aged and aging cells cannot mark the boundary of our inquiries. A further horizon beckons the exploratory student of aging who will seek some understanding of the aging process in the continual ebb and flow of chemical constituents in the living organism. Experimental studies with isotopes (7) and tagged atoms are showing how the constituents of cells, tissues, fluids, and "fixed" structures, such as teeth and bones, are in constant flux as new atoms replace those already in place by a rhythmic process of supersedure (8).

Through experimental manipulations, we can approach more closely the dynamics of the basic living process wherein these subtle and as yet unmeasured alterations of molecular and even atomic structures give rise not only to growth, development, maturation and aging, but apparently also to individual variability and pathological deviations. With the new elements soon to be derived from atomic fissure to supplement the available isotopes and tagged atoms, it will become increasingly possible to study the rate and patterns of activity whereby cells, tissues, and fluids selectively capture from the circulating fluids what each requires for maintaining its differentiated and ever changing structure and highly variable functions. The aging process may thereby become explicable, partially at least, in terms of the changing capacity and cumulative alterations in capturing and incorporating these fugitive atoms and also in releasing them. Thus, the accretions observed in sclerotic changes and in calcifications and similar cumulative alterations may become understandable as a result of diminishing capacity for releasing atoms which in the younger organism are freely relinquished and replaced. Contrariwise, the dehydration and shrinkage and decalcification of bones may indicate inability to retain atoms.

It will be desirable to emphasize in all studies of aging the concurrent processes of maturation shown by the growing and developing organism. Maturity is customarily regarded as a state or fixed condition to which the juvenile organism approximates when reaching the adult years. Maturation has, therefore, been interpreted normatively, with more or less rigid criteria based on chronological age. But maturation, like aging, is an ongoing process, operating in gestation, infancy, childhood and adolescence, indeed, throughout the life career in the continuous biological transformations and progressive integrations through which the organism attempts to meet the tasks of life and of social and interpersonal requirements.

Maturity, in this view, becomes not a fixed goal or state, but rather the successive approximations to adequacy of functioning

and of conduct whereby the individual progresses from conception to death. We may speak, then, of an infant being more or less mature (or premature) according to his capacity to meet life on an infantile level of adequacy, or of a child or adolescent being mature on the successive levels of biological, social and personal adequacy.

Maturing might then be conceived as the melody of living played against the bass of aging in the counterpoint of life. The organism's approach to progressive enhancement of living on each successive level is balanced, reinforced, checked, or overcome by the cumulative and insistent process of aging which brings impairments and dysfunctions that undermine the individual's attempt to maintain his integrity and organic equilibrium.

Such a conception of the interplay of maturation and of aging will remind us that the criteria of adequacy must be established in terms of what is biologically, socially, and personally appropriate at each stage of maturation for each individual with his unique inheritance, life experiences, and personality makeup.

We cannot, therefore, reasonably expect an individual at sixty to exhibit the functional capacities he had at thirty. On the contrary, should we impose undue restrictions upon aging individuals solely in terms of their chronological age since cessation of activity and withdrawal from customary pursuits may bring accelerated aging through sheer disuse?

The customary practice of measuring the individual's functional processes at rest reveals his status or basal functional patterns and conditions. These should be supplemented by careful observations and, whenever possible, measurements of the individual's dynamic response to imposed loads, such as exercise, anoxemia, or other functional tests. It has been shown that the aged individual often shows an impairment of homeostatic capacity which becomes more significant when viewed as part of the cyclical alterations in internal stability throughout the life span. The infant, while functionally competent in his individual organ systems and functional processes, initially shows only a static capacity for maintaining internal stability: When put under stress the infant "drifts" back to equilibrium, being unable to mobilize the reserves and physiological compensations to offset and neutralize loads and stresses.

While the child shortly before puberty usually attains a fairly steady state, during adolescence he may again become physiologically unstable. In the later years of adolescence and early adult life, he again approaches the "steady state" of the adult but with already diminishing capacity for the quick recovery of childhood and of younger adolescence. Then, with greater or less rapidity, accelerated during the involutionary period, the individual again loses his capacity for homeostasis as if involution were a mirror image of adolescence with senescence as a return to the physiological instability of infancy, namely, static equilibrium with little capacity for quick recovery and maintenance of internal balance.

There is an urgent need for more understanding of these physiological changes during involution and senescence, especially for development of some method of establishing the "physiological age" of individuals as distinguished from their chronological age.

Since involution involves a seemingly progressive regression of the generative organs and their utilization of the several hormones derived from the pituitary, thyroid, adrenals, and so on, the individual attainment of postinvolution equilibrium on an altered level poses the difficult and seemingly unanswerable question of the role of these internal secretions in the organic economy when no longer selectively withdrawn from the circulation and utilized for the functional processes of these now inactive generative organs. The operation of these hormones is a crucial question for geriatric medicine since they appear to be involved in some forms of malignancy and may contribute to some of the common de-

generative changes of involution and senescence.

A rehearsal of these many aspects of the aging process and of the present uncertainty and lack of theoretical clarity is justified in this context because it serves to emphasize again that gerontology is an enterprise calling for many and diversified studies, for pooled and concerted investigations, indeed, for the orchestration of all relevant disciplines and professional practices. Only through such a broad, all embracing approach can we hope to cope with this multi-dimensional problem.

Moreover, this extended discussion of some of the baffling problems in the field of aging may also stimulate further critical, reflective thinking on these problems and a greater readiness to consider how we can develop the new concepts and new methodologies commensurate with these perplexing and elusive complexities. It begins to appear that however fruitful for many specialized studies are the familiar cause and effect relationships or the correlation of two variables, they will not suffice for the study of a large number of concurrent processes and functional activities. For an adequate formulation of the larger problem of aging, field theory may offer a much needed conceptual tool for grasping the totality of organic structures and functioning. They should be viewed, not as a series of discrete parts or activities which are somehow organized into a whole, but as a field with separately distinguishable parts and activities which together constitute the whole, and which, in turn, patterns these parts as they act, react, and interact within the framework of the organism and its changing environment. The field concept is already proving valuable in embryology, which, like gerontology, must strive to embrace the totality of ongoing activities, processes, and changing structures, functions, and reactions (9).

It may also be urged that gerontology may wisely and fruitfully approach its problems in terms of what the writer has designated as "biological relativity"; that is, applying the principle that every observation or measurement must be ordered to the field (or frame of reference) in which it occurs so that the same quantitative measurements observed in a group of organisms may, *in the field of each individual organism*, have a different significance for each organism, while different quantitative measurements may have like or equivalent significances. This will shift the customary search for quantitative uniformities and reliance upon the various statistical findings (modes, medians, averages, central tendencies with indices of correlation and dispersion) to a concern for biological equivalents. Likewise, such a reorientation will tend to focus attention upon revealing similar patterns and the processes involved, recognizing that the same basic process may, when operating in different organisms, give rise to different products which, because of our preoccupation with measurements of these products, obscures the underlying process and neglects the common pattern. Biological relativity, therefore, may be regarded as the systematic application of what the good clinician has learned to do when he reinterprets and translates the quantitative laboratory and diagnostic findings into relative terms to reflect the patient's age, sex, occupation, previous illness, and life experiences.

It may be appropriate, therefore, to suggest that the precise controlled experimental studies of the laboratory will increasingly provide the specialized knowledge and techniques necessary for understanding the many organic processes and parts. These in turn must be utilized for studying individual aging organisms, to be observed, so far as possible, longitudinally over a period of years and, ideally, through their life time, to provide the kind of knowledge and the concerted findings needed for the full realization of what gerontology means.

Gerontology, it should be recognized, does not imply any need for regimentation of research or any diversion of investigators from pursuing the problems of major

interest to their disciplines. Gerontology, as stated earlier, is a response to the challenge of this multi-dimensional problem and an effort to stimulate and integrate these many specialized studies. It is an attempt to foster more concerted studies and more clinical findings in the biological and medical sciences.

But even this enlarged conception of the problem of aging, almost overwhelming in its diversified aspects and complicated interrelations, is not adequate for the present day situation. Today we are confronted with the exigent task of maintaining social order while recognizing or replacing many of our cherished traditions and our long established social institutions and practices which have become obsolete and so are producing some of the contemporary social disorder, bitter conflicts, and widespread human frustration and defeat. This task is becoming more difficult by reason of the steadily growing number and proportion of older men and women in our population.

These older men and women tend to fear and to resist change at a time when it has become imperative to reduce the discrepancy between the political, economic, and social practices of the nineteenth century and the technological and other developments of recent years (10). The stresses, strains, and defeats to which we are all exposed in our personal, family, and social living are fostering an accelerated aging among younger adults (as shown by the frequency of chronic illness, mental disorders, and psychosomatic disorders appearing in the thirty and forty year olds) and are bringing increasingly difficult adjustments for those over fifty.

Recent social security legislation, federal and state, especially the provisions for retirement allowances, is at once a recognition of the increased numbers of aged and their often unfortunate lot after a lifetime of work. It is an earnest of what will probably follow in providing housing, health, medical care, and other facilities, including recreation, for the aged.

The American economy has for generations been oriented to and expectant of a constantly increasing population, predominantly of young adults with a large number of children. To feed, clothe, house, educate, entertain, and otherwise to care for more and more people every decade gave American business an ever expanding market and supply of labor.

Now our population growth has slowed down and the number and percentage of older men and women is increasing, thus bringing a series of readjustments for all organized activities and professions. While there will continue to be a demand for houses, furniture, infants' and children's goods, and the food to feed growing appetites, this demand will decline relative to the more limited needs and requirements of older people who will, however, call for more hospitals and medical services, nursing, suitable housing, and other services.

We have scarcely begun to realize the variety and magnitude of the social, economic, and political readjustments that must soon be made—indeed, in some areas and fields are long overdue. We have not yet formulated a long-term nationwide policy to guide the innumerable decisions and transitions we must make, all rendered increasingly difficult by the postwar reconversion, by the existence of the largest number of adults in the wage earning years in our history, and by the confusion and breakdown of so many traditional beliefs and practices. It is evident that the conservatism of the aged will further complicate the task, especially since so many of the middle aged are becoming acutely anxious in the face of the social and international disorder we face.

Yet, we must courageously and energetically plan for the days ahead and incorporate in city planning, housing, postwar public works, and administrative programs more adequate provision for the growing number of older men and, particularly, older women who will continue to outnumber the men over fifty.

It must be clear, then, that we need many more studies by the social scientists

into these many aspects of aging in order to provide a better understanding of these recent developments and trends and to give those who must make decisions and formulate regulations and administrative directives the necessary orientation to a society composed predominantly of adults and older persons (11).

Moreover, it seems evident that there must be a close working relation and reciprocal interchange among all students of aging since those engaged in the conduct of industry and agriculture and other activities must be ever more concerned for the older persons they employ and serve and advised how and what to do according to best available scientific knowledge. Likewise, all professional practitioners—physicians, lawyers, architects, engineers, ministers, social workers, nurses, and others—will need the help of those who are studying the aged and the needs and hazards of aging. This will lead back to the professional schools and necessitate changes in their educational programs in order that the various professional workers will be better prepared for serving the aged.

Because so few can meet the readjustments of advancing years after fifty with wisdom and courage, there will be a growing need of counsellors for the aged. In part, this need will be met by ministers, priests, rabbis, by social workers, by physicians, especially those who specialize in geriatrics, but the old age counsellor may become necessary to bring the more specialized knowledge and skills of all these established professions into a coherent way of life for individual men and women.

The further development of geriatrics can be confidently predicted since the medical problems of the aged and of the aging present a variety of difficult questions of diagnosis and of therapy, calling for modifications and substitutions of many established practices. There will be need for more clinics and hospital facilities for care of the aged, to provide teaching material, especially for postgraduate training of the more experienced physicians who can bring to geriatric medicine the cumulative experience needed for wise and understanding treatment of the aged. But the specialists in geriatrics must be constantly informed by new discoveries and methods if they are to advance their specialty and meet the needs of the older patient, especially the emotional and personality difficulties. Geriatrics, like pediatrics, must be psychosomatic medicine.

Social psychiatry, meaning not only diagnosis and treatment of individual patients but the application of psychiatric and psychologic insights and knowledge to social life, especially through the indirect ways of communication, of the arts (radio and movies) and of group work and group therapy, faces an unparalleled opportunity in the care of the aged.

Statistically there are millions of men and women growing older, all more or less baffled by the changes within themselves and the confusion and turmoil in the world around them, presenting much the same fundamental needs and problems in the aggregate for which large scale provisions must be made. Yet, each one is a distinct, unique organism-personality, with his or her idiosyncrasies of functioning and living, with his or her idiomatic way of acting and feeling, as each one living in his or her private world views the world in terms of memories and expectations, of hopes and fears. For each one, therefore, even the most generalized and common services and provisions must be rendered to and for an individual.

This, then, is the test of our many organizations, institutions, professions, and services which the pressure of technology and of standardization is driving toward a large, impersonal rigidity that may become more terrifying than the ills, hazards, and insecurities against which they are organized to defend us.

We need a national policy for the aged to provide clearly enunciated goals and values by which to guide this ever growing and ramifying set of organizations and personnel in what they do and how they con-

duct their operations and practices as they affect the aged. We need a national policy to guide our social, political, and especially our economic activities toward more conservative operations to replace the present, almost brutal, neglect or callous dismissal of the aged, so many of whom have been ruthlessly misused and prematurely aged by our current practices.

There is a widespread feeling of defeatism about old age as if the last years of life, the period of later maturity, were inevitably a barren, tragic time of decline and frustration. Throughout the ages the dream of a ripe old age has been the much prized goal of life which only a few could attain. Those who did survive the early mortality that carried off most of their generation enjoyed the prestige and the responsibilities of their more or less unique position and accumulated experiences of life. Now much of the wisdom of the aged has become less valuable, if not misleading and sometimes harmful, because of the rapid march of events and of social and cultural changes. Moreover, medicine and public health plus other aids to living have greatly increased the expectation of life and so increased the numbers of the aged. Thus, the long sought goal of old age is being realized by ever larger numbers who are scarcely prepared to use these added years for personal fulfillment or social living.

As Dr. George Morris Piersol so aptly remarked, our concern today should be "not more years to life, but more life to years." This means creating new designs for living in and through which the aging individual can find what will be appropriate to his needs, capacities and interests, thus avoiding a premature cessation of activities with the functional and intellectual atrophy so often entailed by forced withdrawal. On the other hand, there is an urgent need for some procedure that will release the individual from those relentless ambitions which so often continue to drive him long after the day when he should gracefully yield to his successors and enjoy the fruits of his achievements.

For all these problems we must have more research, both intensive investigations of ever more sharply focussed problems and more embracing studies of aging in individuals and of the meaning of an aging population for social order. We must have more explorations in preventive medicine or health care, using the promise of improved nutrition and better convalescence to reduce the heavy toll of years and illness. We must provide more guidance for the aged and incorporate the growing knowledge of the needs of the aged into city planning, housing, and various organizations and services. We must recognize that old age pensions, if not supplemented and enlarged by these other aids to living, may only increase the present widespread tragedy of the aged.

If our belief in the dignity of man *and* woman is to mean anything, and if our traditional conviction of the value and worth of the individual personality is to be directive in our social life, then we cannot permit the present unnecessary wastage of our human resources, especially of adults dying prematurely or living painfully with their various impairments, dysfunctions, and cumulative degeneration or deterioration, exposed to the many unnecessary hazards, threats, and frustrations that now afflict the middle aged and the aged. We cannot call ourselves truly a democratic society unless we accept the task of human conservation as the democratic goal and dedicate our resources to its early attainment (12). This means protecting and conserving all members of our society but especially those past fifty and also the babies and young children who must now be reared and encouraged to meet the longer life span that will await them.

Thus, what we do or fail to do for our human resources will provide a crucial test of our democratic faith and likewise of our ability to maintain a free social order in the face of the mounting insecurity and disorder of our postwar world.

Through gerontology, as a multi-disciplinary enterprise, we may demonstrate

how the varied resources of scientific endeavor and of different professional groups may be enlisted in a concerted effort to meet one of our major problems. The JOURNAL OF GERONTOLOGY, as the first journal dedicated to this theme, provides a medium of communication and of interpretation commensurate in scope and purpose with that problem. As Thomas Hobber pointed out, not the people of long ago when the world was younger, but we of today are the aged, the ancients of days.

REFERENCES

1. *Social Adjustment in Old Age, A Research Planning Report*, Committee Report, Committee on Social Adjustment, Social Science Research Council, 1945.
2. Richardson, Henry B., *Patients Have Families*, New York Commonwealth Fund, 1945.
3. Frank, L. K., "Man's Multi-Dimensional Environment," *Scient. Monthly*, 61: 344–358, 1945.
4. Calingaert, George, "A New Reaction in Organic Chemistry: The Redistribution Reaction," *Science*, 90: 430–434, 1939. Carrell, Alexis, "Physiological Time," *Science*, 74: 618, 1931. DuNouy, P. L., *Biological Time*, New York, Macmillan, 1937.
5. Frank, L. K., "Structure, Function and Growth," *Philosophy of Science*, 11: 210–235, 1935.
6. Krogman, Wilton M., "Trends in the Study of Physical Growth in Children," *Child Development*, 11: 279–284, 1940.
7. Schoenheimer, R., *The Dynamic State of Body Constituents*, Harvard, Cambridge, 1942. Hamilton, J. G., "Applications of Radioactive Tracers to Biology and Medicine," *Journal of Applied Physics*, 12: 440, 1941.
8. Cooper, Z. K., and Schiff, Alice, "Mitotic Rhythm in Human Epidermis," *Proc. Soc. Exper. Biol. and Med.*, 39: 323–324, 1945.
9. Northrop, F. S. C., "The Method and Theories of Physical Science in Their Bearing Upon Biological Organization," *Growth Supplement*, 127–154, 1940.
10. Lawton, George, *New Goals for Old Age*, New York, Columbia Univ. Press, 1943.
11. Simmons, Leo W., "A Prospectus for Field Research in the Position and Treatment of the Aged in Primitive and other Societies," *Amer. Anthropologist*, 47: 433–438, 1945.
12. Frank, L. K., Human Conservation, National Resources Planning Board, March 1943. Supt. of Documents, Washington, D. C.

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ABSTRACT

With millions of men and women growing older, baffled by changes in themselves and in the world around them, the country has a definite need for not only large scale provisions for their care but also for a specific and individual service for each one. Against the present, almost brutal neglect of the aged, by which many have been misused, we need a national policy to guide our social, political, and economic activities toward the aged. Scientific endeavors may be enlisted to aid in this major problem of preventing wastage of human resources and of increasing human conservation. The JOURNAL OF GERONTOLOGY, the first journal in the field, will provide a medium of communication and of interpretation in our effort to gain more and surer knowledge of human growth and development. For all the problems of aging we must have more research, more explorations in health care, more guidance for the aged, and we must incorporate this knowledge into our various organizations and services to protect and conserve all members of society.

RÉSUMÉ

Avec des millions d'hommes et de femmes qui vieillissent, déconcertés par les changements qui se passent en eux et dans le monde autour d'eux, le pays a un besoin très défini, non seulement de pourvoir à leurs besoins sur une grande échelle, mais aussi d'organiser un service spécifique et individuel pour chacun d'eux. Au lieu de la presque brutale négligence actuelle des personnes âgées, dont beaucoup ont été abusées, nous avons besoin d'une méthode nationale pour guider nos activités sociales, politiques et économiques envers les personnes âgées. Les efforts de la science peuvent être engagés pour aider à la solution du problème si important de la prévention du gaspillage des ressources humaines et de l'augmentation de la conservation de la race. Le Journal de Gérontologie, le premier publié dans ce champ d'études, procurera un moyen de communication et d'interprétation de nos efforts dans la recherche de connaissances plus nombreuses et plus sûres sur la croissance humaine et son développement. Nous devons faire plus de recherches sur les problèmes du vieillissement, plus d'explorations sur les soins de la santé, donner plus de directives aux personnes âgées et nous devons incorporer ces connaissances dans nos différentes organisations et services pour la protection et la conservation de tous les membres de la société.

SUMARIO

Con millones de hombres y mujeres que envejecen desencantados por los cambios ocurridos en ellos mismos y en el mundo que los rodea, el país tiene una necesidad definida, no sólo de previsiones en gran escala para su cuidado, sino también de un servicio específico e individual para cada uno de ellos. Contra el presente y casi brutal descuido para con los viejos, por el cual se ha abusado de muchos de ellos, necesitamos una política nacional que encauce nuestras actividades sociales, políticas y económicas hacia la vejez. Pueden ser utilizados procedimientos ceintíficos para ayudar en este magno problema de prevenir el desperdicio de los recursos humanos e incrementar a la vez la conservación humana. El "Diario de Gerontología," el primero en este campo de la ciencia, proveerá un medio de comunicación e interpretación en nuestro esfuerzo por obtener un mayor y más seguro conocimiento del crecimiento y desarrollo humanos. Para todos los problemas del que envejece debemos tener más indagaciones, más exploraciones en el cuidado de la salud, mejor dirección para la vejez, y debemos, además, incorporar este conocimiento a nuestras varias organizaciones y servicios destinados a proteger y conservar a todos los miembros de la sociedad.

СВОДКА

Каждая страна, в которой миллионы стареющих людей сбиты с толку происходящими в них самих и в окружающем их мире переменами, должна позаботиться об уходе за стариками не только в общем масштабе, но и обеспечить индивидуальный уход за каждым из них. Вместо теперешнего, почти абсолютного невнимания к старикам, от которого многие из них очень страдают, нам необходимо выработать национальную программу социального, политического и экономического обслуживания стариков. Ученые могли бы оказать существенную помощь в разрешении важнейшей задачи сохранения и продления человеческой жизни. Журнал Геронтология (Наука о старости) — первый в этой отрасли — будет давать отчеты о наших попытках и усилиях точного и лучшего изучения роста и развития человека. Необходимо больше исследований, серьезное изучение всех проблем, касающихся здоровья стариков и руководства ими. О полученных результатах должны быть уведомлены различные организации, которые провели бы их в жизнь в целях улучшения быта и продления жизни всех членов общества.

I have discovered the fountain of youth. The secret is simple. Never let your brain grow inactive, and you will keep young forever.

CLEMENCEAU

Logarithmic Increase in Mortality As a Manifestation of Aging

HENRY S. SIMMS

DR. SIMMS HAS PLOTTED THE DEATH RATE FROM THE VARIOUS DISEASES AND HAS OBTAINED LOGARITHMIC MORTALITY CURVES WHICH FOR MOST DISEASES ARE APPROXIMATELY STRAIGHT LINES THROUGHOUT ADULT LIFE. AT PRESENT THERE IS NO PROOF FOR OR AGAINST THE IDEA THAT THESE MORTALITY RATES CAN BE MAINTAINED CONSTANT, THUS EXTENDING OUR ACTIVE LIFE WITH RETENTION OF YOUTHFUL HEALTH, INTELLIGENCE, AND APPEARANCE, BUT IF WE COULD MAINTAIN THE MORTALITY RATE FROM DISEASE AT THE LEVEL OF THE AGE OF TEN, MAN WOULD HAVE A LIFE EXPECTANCY OF EIGHT HUNDRED YEARS AND SOME INDIVIDUALS MIGHT SURVIVE TWENTY-TWO THOUSAND YEARS.

IN ORDER to investigate the process of aging in a scientific manner, it is desirable to select one or more important manifestations of aging which are subject to accurate measurement, to statistical analysis and to experimentation. The laws governing these manifestations should be determined, and their causes should be investigated by suitable experimentation.

Aging has two outstanding manifestations. One is the progressive loss of physical and mental abilities—but this is not amenable at this time to accurate measurement or experimentation.

The other outstanding manifestation is the progressive increase in death rate with increasing age. This paper is concerned with the laws which govern the relation between death rate and age.

The human death rate has been shown (1), (2), (3) to increase progressively after the age of 10. After the age of 35 the mortality from all causes obeys the following logarithmic equations,[1] where P_t is the probability of death at age t, P_0 is the (extrapolated) probability of death at birth and k_e and k_{10} are constants:

$$\log_e \frac{P_t}{P_0} = k_e t \qquad (1a)$$

or

$$\log_{10} \frac{P_t}{P_0} = k_{10} t \qquad (1b)$$

where

$$k_e = 2.3 k_{10}$$

These equations are purely empirical and express a relation between mortality rate and age which was observed by Gompertz more than a century ago (4) and has since then been used with modifications by actuarians. The biological significance of these equations and of logarithmic mortality curves has been discussed by Putter (5), Kupfmuller (6), Pearl (7), Brody (8), Nathan (9), and Bernstein (10).

LOGARITHMIC MORTALITY CURVES

In Figure 1, it will be seen that if the mortality rate is plotted as a linear function against age, a curve is obtained which is nearly horizontal up to the age of 50, and which is nearly vertical after the age of 70. The whole curve is far from being a straight line (compare with the dotted line), and hence its shape cannot be accounted for by the random accumulation of pathological conditions.

[1] These equations can also be expressed in the following exponential forms. All four forms represent the same equation and will be referred to merely as "Equation (1)."

$$P_t = P_0 e^{k_e t} \qquad (1c)$$

$$P_t = P_0 10^{k_{10} t} \qquad (1d)$$

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This investigation is a part of the Program for Research on Aging at the College of Physicians and Surgeons, aided by grants from the Josiah Macy, Jr. Foundation, W. R. Warner and Company, and the Wendell L. Willkie Memorial grant of the Albert and Mary Lasker Foundation.

Logarithmic Mortality Curve of Total Deaths.—In Figure 2, the logarithm of the mortality rate in the United States in 1936 is plotted against age. Here it will be seen that after the age of 35 the curve is essentially a straight line. The equation for this line is Equation (1) which is given above. This curve is for total deaths from all causes.[2]

[2] In this and the other charts in this paper the probability of death is computed by dividing the number of deaths in each age group in the United States during the year 1936 (11) by the number of persons living in the same age group, according to the 1930 census. There is, of course, a slight error in all the values due to the use of data for two different years, but the effect of this discrepancy on the curves shown in this paper is negligible.

The data in Table II are computed from a different year (1943).

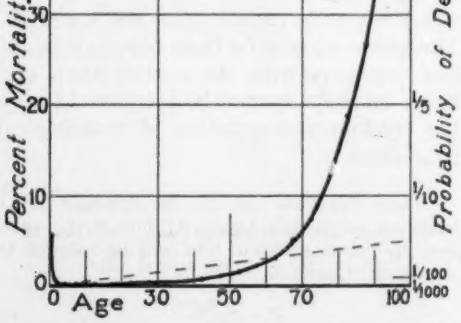

FIG. 1. Mortality plotted as a linear function against age. (All Causes, U. S., 1936.)

Logarithmic Mortality Curves for Each Disease.—It is possible to plot similar mortality curves for each cause of death. This has been done for a number of diseases in Figures 3, 4, and 5. In a previous paper (1) it was pointed out that the mortality rates from most of the diseases increase with age according to Equation (1), but that the rate of increase, as represented by the constant k, is dependent upon the type of disease. The straight portion of each curve is characterized by two constants: P_0 (which indicates the initial mortality from the disease) and k (which is a measure of the rate at which the mortality increases).

Three Types of Diseases.—In Figure 3, it will be seen that a group of infectious diseases, including lobar pneumonia, influenza, bronchopneumonia, and malaria, all have similar curves which are nearly

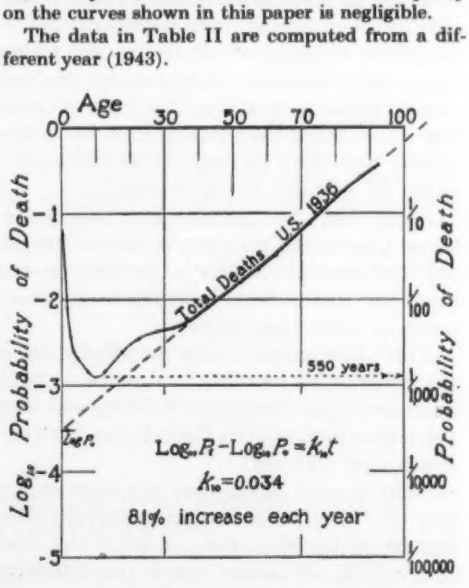

FIG. 2. Logarithm of mortality, plotted against age. (All Causes, U. S., 1936.)

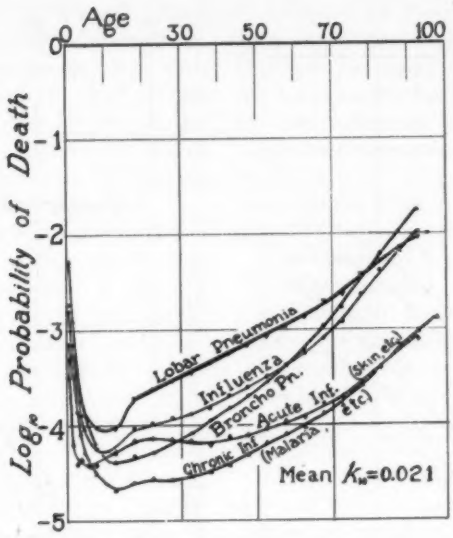

FIG. 3. Infectious Diseases (Group AI).

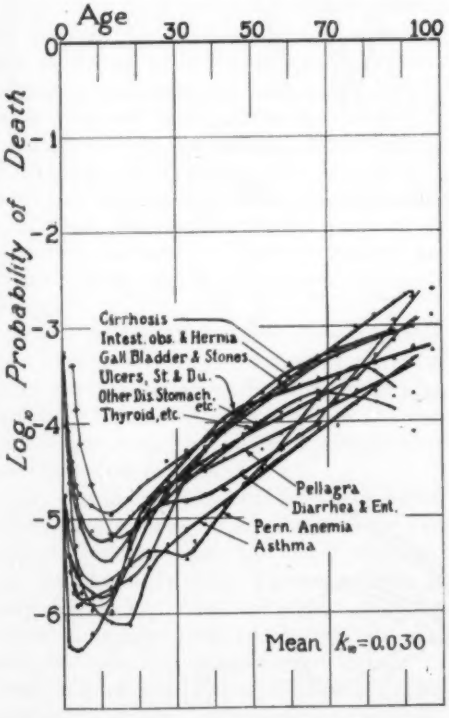

FIG. 4. Organ and Tissue Diseases (Group AII).

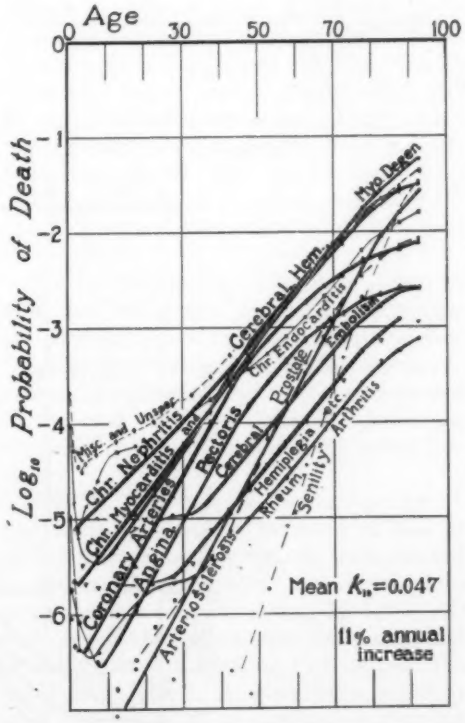

FIG. 5. Cardiovascular-Renal Diseases (Group B).

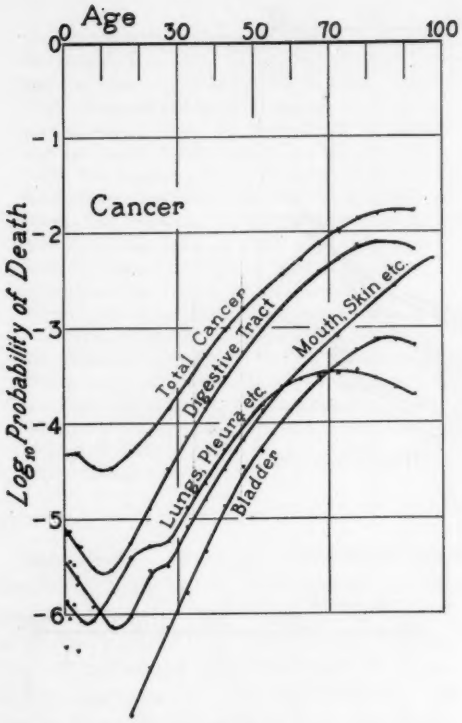

FIG. 6

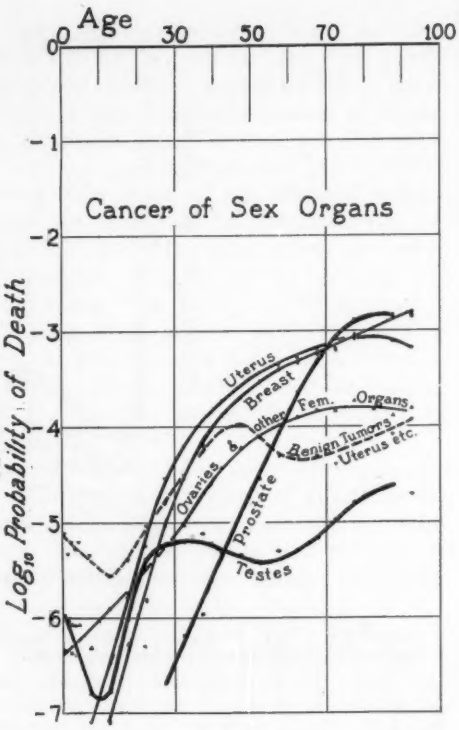

FIG. 7

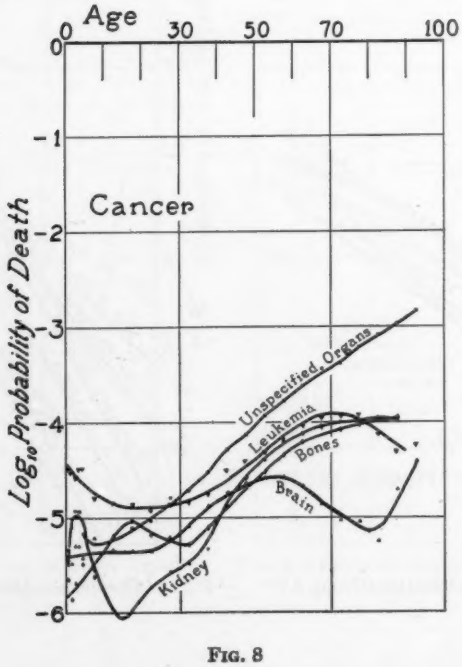

FIG. 8

straight after the age of fifteen. Their curves are essentially parallel to each other. The slope of each curve corresponds with a value of k in Equation (1). For all the diseases in this group the slopes of the curves are gradual, and hence the values of k are low. The mean death rate from these diseases increases five per cent yearly.

The curves in Figure 3 differ from each other in their position on the chart even though the slopes are similar. If the approximately straight portion of each curve is extrapolated to zero age, the intercept P_0 represents the vertical position of the curve and is a measure of the initial mortality from the particular disease.

In Figure 4 we have another group of diseases which have curves similar to each other but which are steeper than those in Figure 3. Hence, these diseases have a higher value of k. The mean death rate from these diseases increases seven per cent yearly. It will be noted that these diseases are for the most part the result of failure of a given tissue or organ and they have surprising similarity to each other insofar as the slopes of their curves are concerned.

In Figure 5 we have a third general group of diseases all of which have exceedingly steep curves (high k values). The mortality from these diseases increases over eleven per cent annually. These diseases are largely those of the cardiovascular-renal system.

It will be noted that the curves in Figures 3 and 4 have a minimum point at about the age of ten with a relatively high mortality below that age, whereas the cardiovascular-renal diseases in Figure 5 have low childhood mortality.

The diseases in Figure 5 are those which afflict older people. These diseases are not restricted to the aged, but occur throughout the whole life span. Their incidence in early life is low (small P_0) but they increase so rapidly with increasing age that they become the predominant causes of death in later life. These diseases are often referred to as the "degenerative diseases" but might more properly be called "adult diseases."

Cancer.—In Figures 6, 7, and 8 will be seen curves for the mortality from cancer. Between the ages of 10 and 70 the curve for total cancer in Fig. 6 resembles those for the cardiovascular-renal diseases. Contrary to statements in the press, cancer deaths are at all ages considerably fewer than deaths from cardiovascular-renal diseases. (Compare with Fig. 12).

The curves in Figure 6 for neoplasms of the digestive tract, lungs and so forth, are fairly smooth and consistent with each other. The curves in Figure 7 for cancer of the various sex organs show the irregularities which are to be expected. In general the cancer curves are inclined to flatten out around the age of 70 or 80.

Exceptional Causes of Death.—In Figure 9 it will be seen that the curves for appendicitis and for tonsillitis show but a gradual increase with age. Perhaps this may be attributed to the fact that the higher age groups contain a large number of individuals who have had their appendices and tonsils removed. Epilepsy also has a nearly horizontal curve, and in Figure 10 it will be seen that tuberculosis has a curve which is practically horizontal after the age of 25. Maternal deaths and deaths from congenital malformations are exceptional for obvious reasons. Chronic alcoholism is also an exception.

Sex Differences.—In Figure 11 it will be seen that the curves for men and women are essentially identical for chronic nephritis, whereas there are slight differences between the mortality curves of the two sexes in the case of tuberculosis. We have not studied the sex differences for other diseases.

Loss of Ability with Increasing Age.—For want of a better measure of loss of ability with increasing age, we have plotted in Figure 12 a curve for male unemployment in the United States in 1930. Although this is an inaccurate measure of loss of ability, it is interesting to note that the logarithmic curve is essentially straight after the age of 45, and parallels that for the death rate from cardiovascular-renal diseases.

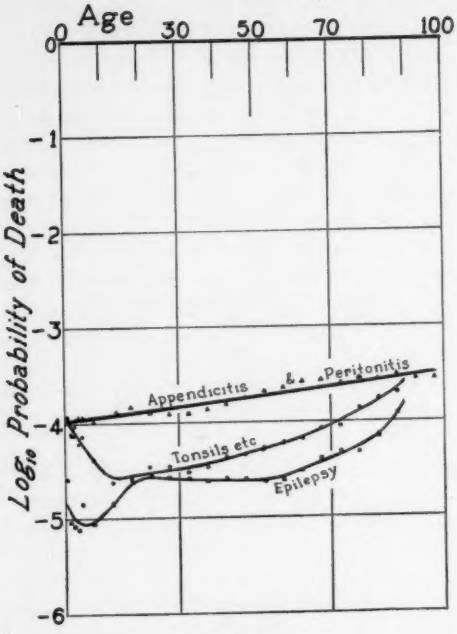

FIG. 9

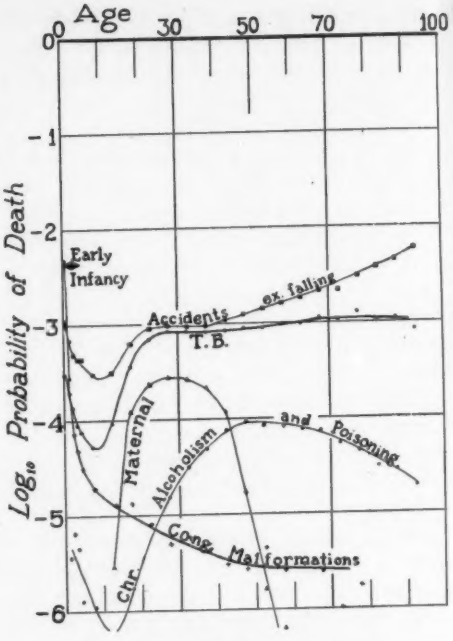

FIG. 10. Exceptional causes of death.

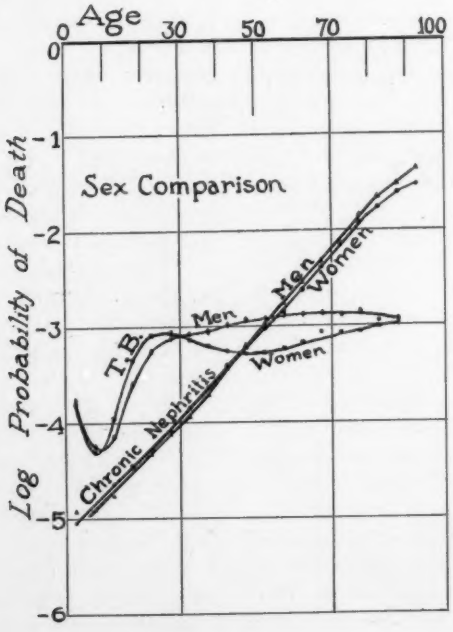

FIG. 11

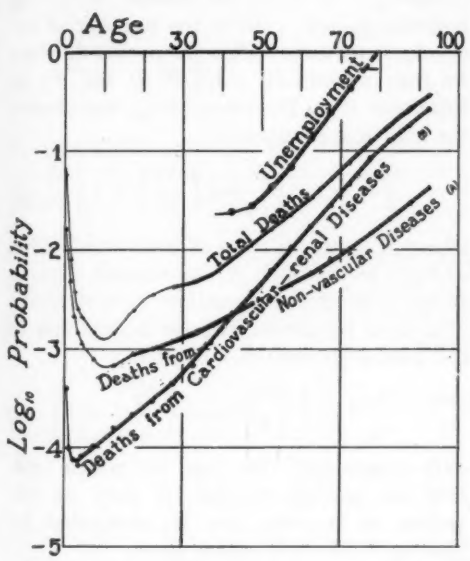

FIG. 12. Loss of ability as measured by unemployment.

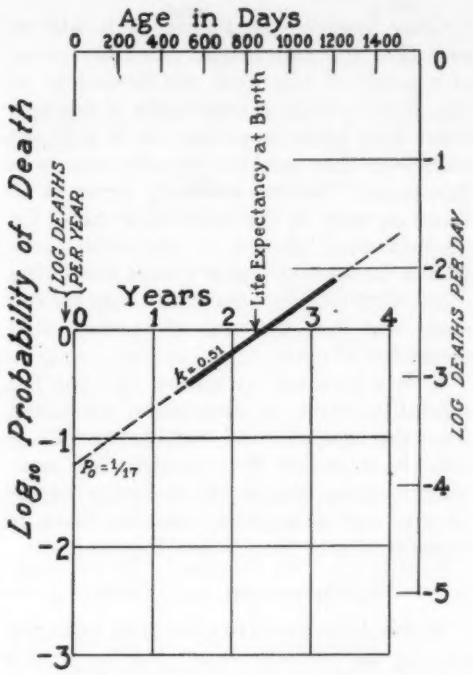

FIG. 13. Mortality curve of rats. This figure is on a different scale than those for human mortality.

TABLE I

	P_0	k	Per Cent Annual Increase in Mortality
Rat	0.058	0.51	224
Human	0.0028	0.034	8.2
Ratio: $\frac{\text{Rat}}{\text{Human}}$	$\frac{21}{1}$	$\frac{15}{1}$	$\frac{27}{1}$

Other Species.—In Figure 13 it will be seen that the logarithmic mortality curve of a group of rats from the laboratory of Dr. McCay (12) is essentially a straight line.[3] This figure is plotted on a different scale from that used for the other charts in this paper. The rat mortality curve is 15 times as steep as the total death curve for humans when plotted on the same scale. It will be seen in Table I that the initial death rate (P_0) for rats is 21 times that of man, and that the rate of increase is 27 times that of man.

It was reported by Brody (8) that the mortality curve of drosophila, computed from the data of Pearl and Parker (13), is also characterized by a straight line logarithmic curve. Hence, the mortality curves of rats and drosophila resemble those of humans in that they follow Equation (1).

MATHEMATICAL EQUATIONS

It should be borne in mind that Equation (1), in its various forms (1a to 1d), is merely an empirical equation which was derived to agree with the data. Its simplicity does not imply that the process of aging which it represents is a simple one. The constant k is a measure of the rate of increase in mortality. It equals the annual change in the value of log P_t. The "per cent annual increase" in death rate (similar to the rate of compound interest on invested capital) is equal to 100 $(10^k - 1)$.

Since the death rate of adults has been found to increase according to Equation (1) it is possible to derive the following useful equations from it (3):

Longevity.—If N is the number of living individuals and $-dN$ is the number of individuals who die within the period dt, then we may substitute $-dN/N \cdot dt$ for P_t in Equation (1c). By integrating, we obtain the following equation:

$$t = \frac{1}{k_e} \log_e \left[\frac{k_e}{P_0} \log_e \left(\frac{N_0}{N_t} \right) + 1 \right] \qquad (2)$$

where N_0 is the number of individuals alive at birth from which N_t individuals survive to age t, (insofar as Equation (1) is obeyed). This may be converted into logarithms to the base 10 (where $k_{10} = 0.434 k_e$):

$$t = \frac{1}{k_{10}} \log_{10} \left[\frac{5.3 k_{10}}{P_0} \log_{10} \left(\frac{N_0}{N_t} \right) + 1 \right] \qquad (3)$$

Life expectancy (the age to which one-half the young individuals may be expected to survive) can be computed by placing $N_0/N_t = 2$, which gives:

$$t = \frac{1}{k_{10}} \log_{10} \left[\frac{1.6 k_{10}}{P_0} + 1 \right] \qquad (4)$$

Maximum Life Span (the age to which one individual out of a large number may be expected to live) may be computed if N_0/N_t is placed equal to the large number (such as 10,000). In this case the number 1 in Equation (3) becomes negligible, hence:

$$t = \frac{1}{k_{10}} \log_{10} \left[\frac{5.3 k_{10}}{P_0} \log_{10} \frac{N_0}{N_t} \right] \qquad (5)$$

Placing N_0/N_t equal to a number still larger than 10,000 does not give a materially higher value of t. Thus for humans in the year 1943 (14) in the United States ($k_{10} = 0.0355$ and $P_0 = 0.00019$) we compute the values given in the second column of Table II. These computations are subject to the assumption that Equation (1) continues to apply to the mortality data after the age of 100. Nevertheless, the chances that anyone has ever lived beyond the age of 110 are extremely improbable.

Calculation of Numbers of Individuals.—In order to compute the number of young

[3] The calculation of the probability of death of rats is more laborious than for humans[2] because of the smaller number of individuals, and hence, the smaller number of deaths within a unit of time. The values of P_t which were plotted in Figure 13 were computed from the equation:

$$1/P_t = N_t \cdot \Delta t / \Delta N$$

ΔN was taken as equal to 8. Hence Δt was the time interval for each 8 deaths (e.g., the time between the first and the ninth deaths, between the second and the tenth, etc.). N_t was the mean number of rats alive during the interval in question. On the day that each rat died it was counted as ½ rat. (Thus, on the day that the number of rats was reduced from 36 to 35 the value of N_t was 35½.)

individuals (N_0) required to give one survivor ($N_t=1$) of age t we can change Equation (3) into the following form:

$$\frac{N_0}{N_t} = 10^{\frac{P_0}{5.3k_{10}}(10^{k_{10}t}-1)} \quad (6)$$

If values of k_{10} and P_0 are known (or assumed) the value of N_0/N_t can be computed.

Similarly the *number of survivors* (N_t) from a given number of young (N_0) at any age (t) can be calculated by the same equation. A survival curve can be computed in this manner.

Potential Life Span.—If the mortality rate were to remain constant throughout our life span, then P_t would have a constant value (P), and k would be equal to zero. In order to compute the life span under such conditions we may write:

$$P = -\frac{dN}{N}dt \quad (7)$$

Integrating this we obtain the following equation:[4]

$$t = \frac{2.3}{P}\log_{10}\frac{N_0}{N_t} \quad (8)$$

From this equation we may obtain *potential life expectancy* (when P is constant and k equals zero) by again taking $N_0/N_t=2$:

$$t = \frac{2.3\times 0.301}{P} = \frac{0.693}{P} \quad (9)$$

Previous computations with this equation, based on 1936 data in the United States, gave a potential life expectancy of 550 years.[2] However, in 1943 the death rate at the age of ten had dropped to only one in 1160. Using this value for P we find that the life expectancy would be about 800 years.

Similarly, *potential maximum life span* can be computed by placing N_0/N_t in Equation (8) equal to a large number. In the last column of Table II it will be seen that out of a number of children equal to the population of the United States we would expect one person to survive *to the*

TABLE II. POTENTIAL LIFE SPAN OF HUMANS

Computed from U. S. mortality data of 1943 (14)

Out of the Following Number of Children	One Individual Should Survive to the Following Age:	
	Under Present Conditions for for Adults (computed from Equation (3) where $k_{10}=0.0355$ and $P_0=1/5{,}250$	If our Death Rate were to Remain Throughout Life as Low As It Is at the Age of Ten (computed from Equation (8) where $P=1/1160$
2 children	70 years*	800 years*
10,000 children	101 years	10,700 years
1,000,000	107	16,000
160,000,000	110	22,000
2,000,000,000	112	25,000

* Life expectancy.

[4] Equation (8) may be derived from Equation (3) by taking advantage of the fact that for values of x approaching zero:

$$\log_e(x+1) = x$$

$$\log_{10}(x+1) = 0.434x.$$

If k in Equation (3) is very small, then the term $(5.3k/P_0)\log_{10}(N_0/N_t)$ will also be very small. Placing this equal to x we obtain Equation (8).

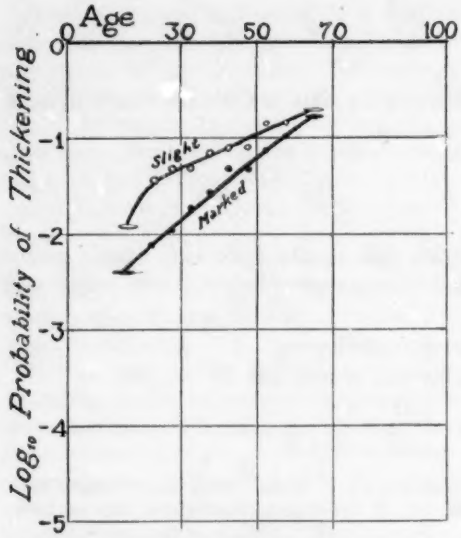

FIG. 14. Incidence of palpable arterial thickening (medial sclerosis) in 10,000 industrial workers. Data from Britten and Thompson.

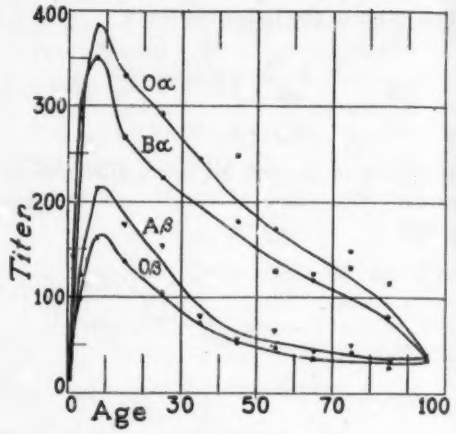

FIG. 15. Changes in iso-agglutinin titer (linear plot). Data from Thomsen and Kettel.

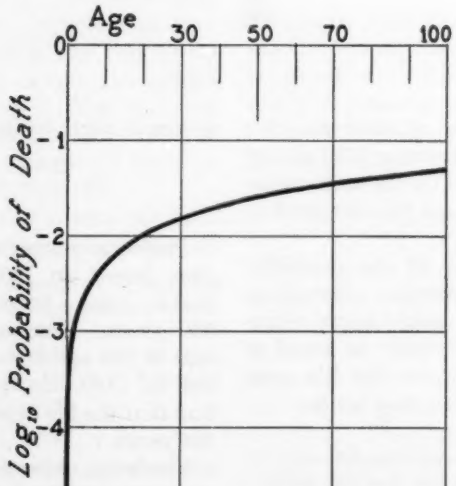

FIG. 16. Theoretical curve for the random accumulation of independent pathological injuries. This corresponds with the straight line which is plotted in Fig. 1.

age of 22,000 years—provided that the mortality rate could be kept at 1 in 1160 throughout that time.

It is unlikely that we can hope to live several thousand years. However, it is entirely conceivable that we can some day extend our active life an extra one hundred or two hundred years with retention of youthful health, intelligence and appearance. This statement is not intended as a prediction. There is as yet no proof for or against such an eventuality. Much more research must be done before we can determine whether a major extension of our years of useful life can become a reality.

DISCUSSION OF MECHANISMS

The charts in this paper show that the increasing death rate with advancing age follows certain laws as far as most causes of death are concerned. Loss of ability appears to follow the same laws. These laws are expressed by the empirical equations which are given above.

Referring again to Figures 3, 4, and 5, it will be seen that the most important causes of death fall into three groups differing from each other in the rate of increase of mortality with age, but identical with each other in that for each disease the death rate increases with advancing age according to Equation (1). There are various factors which may play a role in producing this result.

Arterial Changes.—It is interesting to note that clinical observation of arterial thickening (medial sclerosis) gives values which when plotted on a logarithmic chart give straight line curves. Data from Britten and Thompson (15) are plotted in Figure 14. Although medial sclerosis need not be considered an important cause of death, nevertheless, these findings suggest that arterial changes may increase logarithmically. Unfortunately, similar data on intimal arteriosclerosis are not available.

Immunity Changes.—We saw in Figure 3 and to a lesser extent in Figure 4 that the curves for infectious diseases are high in childhood (before immunity has been acquired) and have a minimum point at the age of ten, after which the mortality rate increases. In Figure 15 is a curve taken from Thomsen and Kettel (16) which shows that the titer of iso-agglutinins has a maximum at the age of ten. In the event the ability to form antibodies against filterable viruses and pathogenic organisms follows a similar trend this would explain the minimum mortality at the age of ten. However, the logarithmic nature of the subsequent rise would require some other explanation.

Accumulation of Pathological Injuries.—There has been a tendency on the part of those interested in gerontology to dismiss the whole problem of the high death rate of older people as being "due to the accumulation of pathological injuries." Such a dismissal of so important a question is unfortunate. It is true that on autopsy older people are found to have more pathological conditions than younger people, but if we are to understand the process of aging, it is important that we should know how these accumulate and why.[5]

The random accumulation of independent injuries should be a straight line if plotted in Figure 1, (note dotted line). On a semi-log plot it should give a curve similar to the curve in Figure 16. This differs so much from the observed mortality curve that we must conclude that the theory of random injuries cannot account for the facts. It remains to be seen what sort of a curve the accumulation of dependent pathological conditions (which result from preceding injuries) will give. However, it seems fairly certain that the process of aging must involve alterations which progressively predispose to the accumulation of more pathological conditions than can be accounted for on a random basis—and/or which render the individual progressively less resistant to the accumulated injuries.

[5] A statistical study is being made by Dr. Dean F. Davies, as part of the Program for Research on Aging at this medical school, to determine to what extent the accumulation of dependent and independent pathological conditions may account for the type of mortality curves which are found.

The lag period between the incipience of a fatal injury and the resulting death would not affect the shape of the mortality curve (provided the lag period were the same throughout life) but would merely displace it to the right.

SUMMARY

By plotting the logarithm of the death rate from each disease, "logarithmic mortality curves" are obtained. For most diseases these curves are essentially straight throughout adult life and, therefore, follow the empirical equation:

$$\log_{10} P_t/P_0 = k_{10}\, t.$$

where P_t is the mortality rate at age t and the constant k_{10} is a measure of the rate at which the mortality increases with age. Most diseases fall into one of three groups:

AI. The infectious diseases, which have a gradual increase in mortality (five per cent increase each year) with increasing age. The diseases in this group are also characterized by a high infant mortality which falls to a minimum at the age of ten, after which there is an increase in accordance with the above equation.

AII. Diseases involving organ or tissue failure. The mortality from these diseases rises at a faster rate than from the infectious diseases (seven per cent increase each year).

B. Diseases of the cardiovascular-renal system. During youth these have a low mortality (low P_0) but the mortality rises so rapidly with increasing age (eleven per cent increase each year) that they become the predominant causes of death in later life.

Curves for cancer of different organs are given. The total deaths from cancer parallel the deaths from cardiovascular-renal diseases, but cancer causes fewer deaths in all age groups.

Unemployment (as a rough measure of loss of ability) is shown to have a curve which parallels those of Group B.

Curves for several exceptional diseases, which do not obey the above equation, are given.

Sex comparisons are made for deaths from tuberculosis and from chronic nephritis.

Rats have a logarithmic mortality curve similar to human beings but 15 times as steep.

The incidence of medial arteriosclerosis rises logarithmically with age.

Formulas are derived for computing life expectancy, maximum life span and survival. Formulas for potential life span (if P_t were constant and k were zero) are derived.

It is computed from data of 1943 that if the mortality rate could be maintained constant at the level of the age of ten, we would have life expectancy of 800 years and some individuals would survive 22,000 years.

There is at this time no proof for or against the possibility that we can some day extend our active life an extra one hundred or two hundred years with retention of youthful health, intelligence, and appearance.

REFERENCES

1. Simms, Henry S., "Physiological Alterations as the Cause of Senile Debility and Senile Mortality," *Science*, 91: 7–9, 1940.
2. Simms, Henry S., "The Problems of Aging and of Vascular Diseases," *Science*, 95: 183–186, 1942.
3. Simms, Henry S., "The Use of a Measurable Cause of Death (Hemorrhage) for Evaluation of Aging," *J. Gen. Physiol.*, 26: 169–178, 1942.
4. Gompertz, B., *Philos. Tr. Roy. Soc. London*, 1825.
5. Putter, A., "Zur Physiologie der Lebensdauer," *Naturwissenschaften*, 8: 201–205, 1920.
6. Kupfmuller, K., "Zur Analysis der Absterbeordnung," *Naturwissenschaften*, 9: 25–31, 1921.
7. Pearl, Raymond, *The Biology of Death*, Philadelphia, Lippincott, 1922.
8. Brody, S., "The Kinetics of Senescence," *J. Gen. Physiol.*, 6: 245–247, 1923.
9. Nathan, E. B., *Trans of the Faculty of Actuaries*, 10: 45. 1924.

10. Bernstein, Felix, *Cold Spring Harbor Symp. Quant. Biol.*, 2: 209, 1934.
11. Bureau of Census, vital statistics, Special Reports, 5, No. 41, 303, 1938.
12. McCay, C. M., Crowell, M. F., and Maynard, L. A., "The Effects of Retarded Growth Upon the Length of Life Span and Upon the Ultimate Body Size.," *J. Nutrition*, 10: 63–79, 1935.
13. Pearl, Raymond, and Parker, S. L., "Experimental Studies on the Duration of Life," *Am. Naturalist*, 55: 481–509, 1921.
14. Bureau of Census, vital statistics, Special Reports 21: No. 13, 204, 1945.
15. Britten, R. H., and Thompson, L. R., "A Health Study of Ten Thousand Male Industrial Workers," U. S. Public Health Bulletin, 162, Washington, 1926.
16. Thomsen, O. and Kettel, K., "Die Starke der menschlichen Isoagglutinine und entsprechenden Blutkorperchenrezeptoren in verschiedenen Lebensaltern," *Zeit. F. Immunitatsforsch. u. exp. Therap.*, 63: 67–93, 1929.

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ABSTRACT

Gompertz, more than a century ago, discovered a definite relation between mortality rate and age. For most diseases logarithmic mortality curves are essentially straight lines throughout adult life. Most diseases may be classified as belonging to three groups: (1) the infectious diseases which have a gradual increase in mortality with increasing age. These diseases are also characterized by a high infant mortality rate which falls to a minimum at the age of ten and then gradually increases again. (2) Diseases involving organ or tissue failure. The mortality from these diseases rises at a faster rate than from infectious diseases. (3) Diseases of the cardiovascular-renal system. During youth these have a low mortality which rises so rapidly with increasing age that they become the predominant causes of death in later life. Interestingly enough, unemployment is shown to have a curve which parallels diseases of the cardiovascular-renal system. It is computed that if the mortality rate could be maintained constant at the level of the age of ten, man would have a life expectancy of 800 years and some individuals would survive 22,000 years. There is no proof that we cannot extend active life an extra 100 or 200 years with retention of youthful health, intelligence, and appearance.

RÉSUMÉ

Il y a plus d'un siècle, Gompertz découvrit une relation définitive entre le degré de mortalité et l'âge. Pour la plupart des maladies, les courbes logarithmiques de mortalité restent essentiellement en droite ligne pendant toute la vie adulte. La plupart des maladies peuvent être classifiées comme appartenant à trois groupes: (1) les maladies infectieuses dont la mortalité augmente graduellement avec l'augmentation de l'âge. Ces maladies sont également caracterisées par un degré de mortalité infantile très élevé qui descend à un minimum à l'âge de dix ans, puis graduellement recommence à augmenter. (2) Les maladies provenant de l'affaiblissement des organes ou des tissus. Le degré de mortalité de ces maladies augmente plus rapidement que pour les maladies infectieuses. (3) Les maladies du système cardiovasculaire-renal. Pendant la jeunesse le degré de mortalité de ces maladies est très bas, mais il augmente si rapidement avec l'âge, que ces maladies deviennent la cause prédominante de mort dans la dernière phase de l'existence. Il est intéressant de noter que le chômage a été démontré avoir une courbe parallèle avec celle des maladies du système cardiovasculaire-renal. Il a été calculé que si le degré de mortalité pouvait être maintenu constamment au niveau de l'âge de dix ans, l'homme pourrait espérer une vie de 800 années et quelques individus pour-

raient survivre pendant 22.000 ans. Il n'y a aucune preuve que nous ne puissions pas prolonger la vie active de 100 ou 200 années en lui conservant la santé de la jeunesse, son intelligence et son apparence.

SUMARIO

Hace más de un siglo que Gompertz descubrió una relación definida entre la rata de mortalidad y la edad. Para muchas enfermedades, las curvas logarítmicas de mortalidad son esencialmente líneas rectas durante toda la vida adulta. La mayor parte de las enfermedades pueden ser clasificadas en tres grupos: (1) las enfermedades infecciosas cuya rata de mortalidad aumenta con la edad. Estas enfermedades están también caracterizadas por una alta rata de mortalidad infantil que alcanza su mínimum a la edad de diez años y luego aumenta gradualmente otra vez. (2) las enfermedades que envuelven falla de un órgano o tejido. La mortalidad a causa de estas enfermedades aumenta en una proporción mayor aún que la de las enfermedades infecciosas. (3) las enfermedades del sistema cardiovascular-renal. Durante la juventud, éstas tienen una baja mortalidad que aumenta tan rapidamente con la edad que llegan a ser la causa predominante de muerte en los años posteriores. Es muy interesante observar que el desempleo muestra tener una curva paralela a la de las enfermedades del sistema cardiovascular-renal. Se calcula que si la rata de mortalidad pudiera mantenerse constantemente al nivel de la de los diez años de edad, el hombre podría esperar vivir unos 800 años, y algunos individuos sobrevivirían 22.000 años. No hay nada que pruebe que no se puede aumentar la duración de una vida activa en 100 o 200 años más, conservando la salud, la inteligencia y la buena apariencia juvenil.

СВОДКА

Свыше столетия тому назад Гомперц нашел определенную связь между процентом смертности и возрастом. Логарифмические кривые смертности от большинства заболеваний в основном остаются без изменений у взрослых. Большинство заболеваний относится к трем группам: 1. Инфекционные болезни, при которых постепенно с возрастом повышается смертность. Эти болезни также характеризуются высоким процентом детской смертности, минимум наблюдается в десятилетнем возрасте, а затем постепенно опять возрастает. 2. Болезни органов и разрушение ткани. Процент смертности от этих болезней увеличивается быстрее, чем от инфекционных заболеваний. 3. Болезни кардио-сосудисто-почечной системы. Смертность от этих болезней в молодости невысока, но увеличивается с возрастом с такой быстротой, что эти болезни являются главной причиной смертности в старшем возрасте. Интересно отметить, что безработица дала кривую, идущую параллельно кардио-сосудисто-почечным заболеваниям. Было высчитано, что если смертность была бы на постоянном уровне смертности десятилетнего возраста человека, то он мог бы жить 550 лет, а в некоторых случаях до 22.000 лет. У нас нет доказательств, что жизнь человека не может быть продлена еще на 100-200 лет с сохранением юношеского здоровья, разума и внешнего вида.

The Relation Between Age of Stem Tissue and the Capacity to Form Roots

P. W. ZIMMERMAN AND A. E. HITCHCOCK

BECAUSE MANY PLANTS, AFTER A CERTAIN AGE, CANNOT BE INDUCED TO FORM NATURAL ROOTS WITHOUT AID OF A ROOT-INDUCING SUBSTANCE, IT IS EVIDENT THAT THERE IS A DEFINITE RELATION BETWEEN THE AGE OF THE PLANT TISSUE AND ITS NATURAL CAPACITY TO FORM ADVENTITIOUS ROOTS. DR. P. W. ZIMMERMAN AND DR. A. E. HITCHCOCK IN THEIR EXPERIMENTS HAVE FOUND THAT THE CHANGE IN STRUCTURE OR PROTOPLASM OF PLANTS WITH AGE IS A MAJOR CONTROLLING FACTOR ON THE MECHANISM IN PLANTS THROUGH WHICH CHEMICALS ACT AND ROOTS ARE FORMED.

A RELATION between the age of plant tissue and its natural capacity to form adventitious roots is evident. Although there is considerable variation among closely related species and varieties, the age factor generally applies to a greater or lesser degree. The apparent age factor can be generally overcome with the aid of hormone-like substances which serve as chemical growth regulators (4, 6). These have the power to induce adventitious roots on tissues where roots do not naturally appear. For example, roots can be induced on intact plants at nodes or internodes (Fig. 1), on leaves, peduncles, and even on flower petals (5). This shows that structure and age of tissue are not the only factors which appear to govern production of roots. However, the production of natural hormones may be related to structure and age of the tissue. This possibility is suggested by species which have the power to form roots at one stage of development and not earlier or later.

FIG. 1. *Kalanchoe daigremontiana*. One plant with two comparable branches before treatment. Left, lanolin preparation of root-inducing hormone applied around the stem to regulate growth. Right, a control branch not treated.

FIG. 2. Lilac (*Syringa vulgaris* L.) cuttings to show root-inducing power of hormone-like chemicals. Left, control not treated; middle, cutting treated with a low concentration to induce roots at base; right, cutting treated with high concentration to induce roots along the stem as well as at base.

Growth of plant cuttings in relation to age of the tissue can readily be illustrated with lilac species. For example, stem cuttings of young shoots of lilac taken in May have the capacity to grow adventitious roots. They are particularly active if the basal end is treated with a hormone-like

Dr. P. W. Zimmerman received his B.S. degree in 1915, his M.S. in 1916 and his Ph.D. in 1925 from the University of Chicago. He served as assistant botanist at Chicago and as professor and dean of the College of Agriculture at the University of Maryland from 1918 to 1925. Since then he has been plant physiologist at the Boyce Thompson Institute for Plant Research, Inc. in Yonkers, New York.

A graduate of the University of Maryland and of Columbia University where he received his Ph.D. in 1928, Dr. A. E. Hitchcock has been plant physiologist at Boyce Thompson Institute since 1925. He was field assistant during the summer from 1922 to 1925 for the United States Department of Agriculture. He has worked principally on vegetative propagation, effect of gases on plants, plant hormones and growth substances, and growth regulation.

root-inducing substance (Fig. 2). The capacity to form roots gradually declines with the passing of spring and is completely lost by July. At this time the receptor tissue can no longer form roots or make use of artificially applied root-inducing substances.

Apple species furnish even better illustrations than the lilac since they are more limited in their capacity to regenerate lost organs. Apple cuttings rarely form roots without the aid of root-inducing substances. Stem cuttings of young shoots of many varieties of apples taken in early May form roots when treated with growth substances (Fig. 3). Sometime during May the tissue reaches its maximum capacity to regenerate roots. This capacity decreases until June, at which time the receptor tissue can no longer make use of the applied growth substance. Hardwood apple cuttings have been the subject of much investigation, and attempts have repeatedly failed to develop methods to force apple stems to form roots.

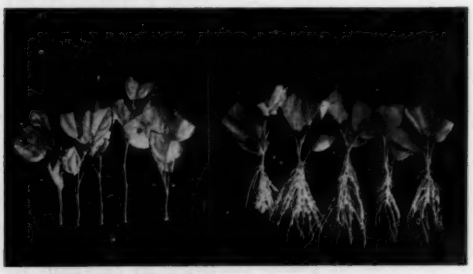

FIG. 3. Apple (*Malus*) cuttings to show that young apple tissue has the capacity to regenerate roots when treated with a growth substance, and it does not root without treatment. Left, control cuttings; right, cuttings treated at the base with a root-inducing substance.

Some species of plants root most readily from old tissue, while others root best from young tissue. American Pillar rose canes grow rapidly, and somewhere within a few inches back of the growing tip the stem tissue has the capacity to regenerate roots when made into cuttings. This location is particularly specific. Younger tissue does not root and neither does older tissue. Closely related species, however, differ widely from this, older tissue rooting with great ease. *Rosa excelsa* is a good example of this.

The relation of rooting response to the age of the tissue at the base of greenwood cuttings was investigated by Hitchcock and Zimmerman (3) who found that the response varied with the type of cutting. Four types were recognized as follows (Fig. 4):

1. Mallet cuttings of previous season's wood.

2. Heel cuttings including a small amount of the previous season's wood.

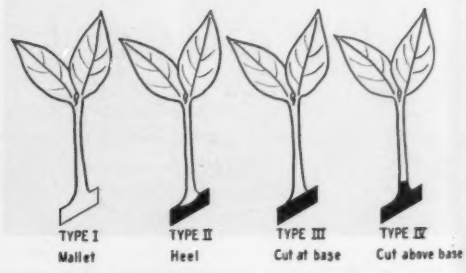

FIG. 4. Four types of cuttings which can be made from similar shoots. The black portion shows the part to be removed in making the different types of cuttings.

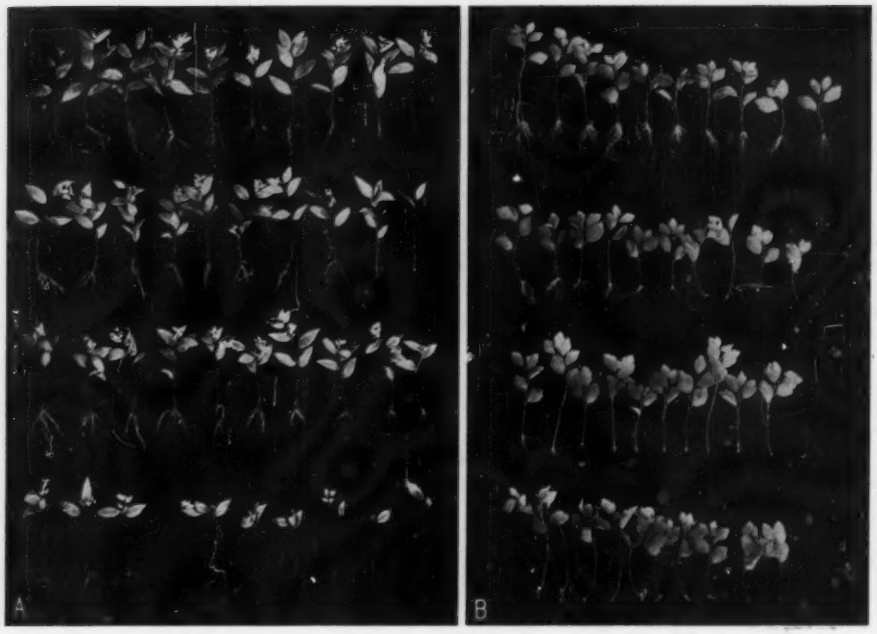

FIG. 5. Two species of *Spiraea* which show a variation in capacity to form roots with different types of cuttings. (A) *Spiraea bumalda* which roots from all types of cuttings. (B) *Spiraea vanhouttei* which shows the variation in capacity to root according to the types of cuttings shown in Figure 4. From top to bottom the cuttings are as follows: cut above base (type IV); cut at base (type III); heel (type II); and mallet cutting involving two-year-old wood (type I).

3. Cuttings with the base made of current season's growth.

4. Cuttings with the base from one-quarter to three-quarters of an inch above the current season's growth.

Rooting varied with the type of cutting and with the species of plants. Although no one of the four types of cuttings always produced the best rooting, the mallet type cutting was generally poor and type 3 was usually good. In certain cases different species of the same genus (Fig. 5) and different varieties of the same species showed differences in rooting (Fig. 6). Though these variations were recognized, no explanation could be given for the differences. The fact that the application of synthetic root-inducing substances failed to bring out roots on some species indicated that the problem is very complex.

Some light was thrown on this subject by the fact that some species of plants such as grape, cucurbit, and clematis had a natural capacity to form roots at the nodes while the internodes formed roots only when treated with root-inducing substances. Cuttings which root only at the base, regardless of any relation to nodes, root also for a considerable distance above the base when treated with the proper root-inducing substance (Figs. 2, 3, 7). It seems, therefore, that the receptor tissue in these cases had all the requirements except the root-inducing substance. In practice it has been found that it is advisable to have the basal cut near the place where the tissue has a natural tendency to form roots. This, however, does not always hold because the basal ends of some species of cuttings form roots without reference to the nodes

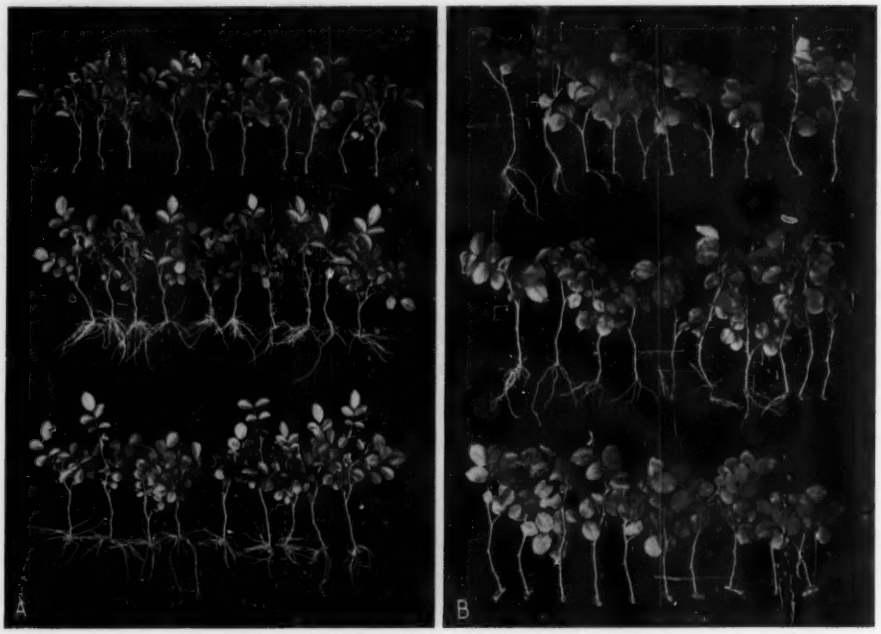

FIG. 6. Two varieties of rose showing difference in capacity to form roots even though the age of the tissue be the same. (A) Dorothy Perkins variety and (B) American Pillar variety. Types of cuttings from top to bottom are as follows: cut made above base involving only current season's wood (type IV); heel cutting with previous season's wood (type II); and mallet cuttings with previous season's wood (type I).

though there may be some relation between rooting and age of the tissue.

It has been frequently pointed out that cuttings made from seedlings of difficultly propagated species have the capacity to form roots, whereas cuttings from old trees of the same species can seldom be induced to root. Most species of pine, chestnut (Fig. 8), and oak afford good illustrations of the latter type. Even though hor-

FIG. 7. Holly cuttings to show capacity to root when treated with a hormone-like substance. Left, control not treated; right, cuttings treated with a root-inducing substance.

FIG. 8. Chestnut cuttings made from one-year-old seedlings. Left, control which lacked the capacity to form roots under natural conditions; right, similar cuttings treated with root-inducing substances.

mone-like substances are applied to the cuttings, the tissue no longer has the capacity to make use of them (1, 2). The mechanism in plants through which chemicals act is not understood, and it is further complicated by the fact that closely related species or varieties differ widely in their responses. The new use of plant hormones has thrown some light on the subject, but it is reasonably certain that the change in structure or protoplasm with age is a major controlling factor.

References

1. Gardner, F. E., "The Relationship between Tree Age and the Rooting of Cuttings," *Proc. Amer. Soc. Hort. Sci.*, 26(1929): 101–104. 1930.
2. Gardner, F. E., and R. B. Piper, "Ease of Propagation of Some Subtropical Fruits by Cuttings from Young Seedlings," *Proc. Ann. Meet. Florida State Hort. Soc.*, 56: 124–126, 1943 (Abstr. in *Biol. Abstr.* 18: 14388, 1944).
3. Hitchcock, A. E., and P. W. Zimmerman, "Relation of Rooting Response to Age of Tissue at the Base of Greenwood Cuttings," *Contrib. Boyce Thompson Inst.*, 4: 85–98, 1932.
4. Hitchcock, A. E., and P. W. Zimmerman, "Comparative Activity of Root-inducing Substances and Methods for Treating Cuttings," *Contrib. Boyce Thompson Inst.*, 10: 461–480, 1939.
5. LaRue, Carl D., "Root Formation on Flowers in Sterile Culture," *Am. J. Bot.*, 24: 739. 1937.
6. Zimmerman, P. W., and A. E. Hitchcock, "Comparative Effectiveness of Acids, Esters, and Salts as Growth Substances and Methods of Evaluating Them," *Contrib. Boyce Thompson Inst.*, 8: 337–350, 1937.

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ABSTRACT

Although there is considerable variation among closely related species and varieties of plants, it is evident that there is a relation between the age of plant tissue and its natural capacity to form adventitious roots. This age factor can generally be overcome with the aid of hormone-like substances which serve as chemical growth regulators, and which have the power to induce adventitious roots on tissues where roots do not naturally appear. Cuttings of the lilac taken in May have the capacity to grow adventitious roots. This capacity gradually declines until it is completely gone by July. Cuttings of apples taken early in May form roots when treated with growth substances, but gradually decline until June. Cuttings from seedlings of difficultly propagated species have the capacity to form roots, whereas cuttings from old trees of the same species can seldom be induced to root, even with the aid of hormone-like substances, because they no longer have the capacity to make use of them. The mechanism in plants through which chemicals act is not understood, and it is further complicated because closely related species differ widely in their response. The new use of plant hormones has thrown some light on the subject, but it is reasonably certain that the change in structure or protoplasm with age is a major controlling factor.

RÉSUMÉ

Bien qu'il y ait une différence considérable entre les espèces et variétés de plantes étroitement apparentées, il est évident qu'il y a une relation entre l'âge des tissus d'une plante et sa capacité naturelle de former des racines accidentelles. Ce facteur de l'âge peut être généralement surmonté avec l'aide de substances semblables à l'hormone qui servent de régulateurs chimiques de la croissance, et qui ont le pouvoir d'occasionner des racines accidentelles sur des tissus où des racines n'apparaissent naturellement pas. Des boutures de lilas prises en mai ont la capacité de donner naissance à des ra-

cincs. Cette capacité diminue peu a peu jusqu'à ce qu'elle disparaisse complètement en juillet. Des boutures de pommiers prises au début de mai orment des racines quand elles sont traitées avec des substances de croissance mais diminuent graduellement jusqu'en juin. Les boutures d'une jeune plante venue de la graine, d'une espèce difficile à propager, ont la capacité de former des racines, tandis que les boutures de vieux arbres de la même espèce peuvent très rarement être poussées à produire des racines, même avec l'aide de substances semblables à l'hormone, parce qu'elles n'ont plus la capacité de s'en servir. Le mécanisme dans les plantes au travers desquelles les produits chimiques agissent n'est pas expliqué et se trouve encore beaucoup plus compliqué par la grande différence des résultats obtenus sur des espèces étroitement apparentées. L'usage récemment fait des hormones de plantes a apporté quelque lumière sur le sujet, mais il est raisonnablement certain que le changement de structure du protoplasme qui se produit avec l'âge est un des principaux facteurs de contrôle.

SUMARIO

Si bien hay una considerable variación entre especies afines y otras variedades de plantas, es evidente también que existe una relación notoria entre la edad del tejido de las plantas y la capacidad de las mismas para formar raíces adventicias. Este factor-edad puede generalmente ser puesto bajo control con la ayuda de sustancias semejantes a las hormonas, las cuales actúan como reguladores químicos del crecimiento, y poseen, además, la propiedad de hacer echar raíces adventicias en tejidos localizados en sitios en donde tales raíces no suelen aparecer naturalmente. Trozos de lila cortados en Mayo tienen la propiedad de echar raíces adventicias. Esta capacidad disminuye gradualmente hasta desaparecer por completo allá por Julio. Trozos de manzano cortados en los primeros días de Mayo echan raíces cuando son tratados con sustancias estimuladoras del crecimiento, pero tal propiedad la pierden gradualmente hasta desaparecer en Junio. Trozos de plantitas de almácigas pertenecientes a especies de propagación difícil tienen la capacidad de echar raíces, mientras que trozos de árboles viejos de las mismas especies rara vez echan tales raíces, ni aun con la ayuda o estímulo de agentes químicos que promuevan el crecimiento, debido a que no conservan por largo tiempo la capacidad de hacer uso de tales sustancias químicas. El acto químico no es entendido a través del mecanismo de las plantas, y hay aún ulteriores complicaciones, debido a que las plantas de familias afines diferen mucho en sus respectivas reacciones. El nuevo uso de hormonas de plantas ha arrojado alguna luz en la materia, pero es además cierto que el cambio, con la edad, en la estructura o protoplasma, constituye un mayor factor de control.

СВОДКА

Хотя значительные различия наблюдаются между близко сродными видами и разновидностями растений, все же ясно, что существует зависимость между возрастом растительной ткани и ее естественной способностью производить подобные корни. Этот возрастный фактор можно предотвратить путем добавления гормоновидных препаратов, которые служат как химические регуляторы роста и которые способны вызывать рост побочных корней на тканях, нормально их не производящих. Отростки сирени, срезанные в мае, могут пустить побочные корни. Эта способность постепенно понижается и совершенно исчезает к июлю. Отростки яблони, срезанные в начале мая, образуют корни, когда они держатся в препарате, вызывающем их рост, но постепенно теряют эту способность к июню. Отростки от рассады трудно размножающихся растений имеют способность образовывать корни, в то время как срезы от старых растений той же самой породы редко пускают корни, даже с помощью вызывающих рост гормонов, потому что у них больше нет способности их утилизировать. Механизм действия различных химических препаратов на растения неизвестен и еще больше затрудняет наблюдение то, что близко родственные разновидности растений реагируют по разному на те же самые препараты. Употребление растительных гормонов несколько осветило этот предмет и вполне вероятно, что изменение в структуре или протоплазме с возрастом является главным контролирующим фактором.

The menopause is the frontier of the territory of old age.
SIR HUMPHREY ROLLESTON

Observations on Aging in Nutritionally Deficient Persons

TOM D. SPIES AND HARVEY S. COLLINS

THE EFFECTS OF LACK OF PROPER NUTRITION NOT ONLY ARE IMPROPERLY ASSUMED TO BE A NATURAL RESULT OF OLD AGE, BUT ALSO TEND TO MAKE A YOUNG PERSON APPEAR MUCH OLDER THAN HE ACTUALLY IS. CASES TREATED AT THE NUTRITION CLINIC AT BIRMINGHAM, ALABAMA, SHOW A DEFINITE RELATION BETWEEN LACK OF PROPER NUTRITION AND APPEARANCE. A WOMAN OF 30, WHO SUFFERED FROM PELLAGRA AS A RESULT OF POOR AND INADEQUATE DIET, WAS JUDGED TO BE FIFTY YEARS OLD. THE SYMPTOMS OF A WOMAN OF 70 WERE ERRONEOUSLY JUDGED TO BE SIMPLY A PART OF GROWING OLD. PROPER TREATMENT AND CORRECT DIAGNOSIS OF NUTRITIONALLY DEFICIENT PEOPLE HAVE SHOWN DEFINITE RESULTS IN BOTH TYPES OF CASES.

WITH the rising tide of longevity among the population of this country geriatrics is a medical responsibility of the first order. At the present time standards of nutrition as related to geriatrics seem arbitrary. Nevertheless, the implications are broad. Despite the staggering complexity of the subject, the application of what little knowledge there is, gives encouraging results. As we look ahead along this new frontier of science the view is excellent. Little by little the virile and brilliant young science of nutrition is throwing light on many branches of medicine including geriatrics. For the medical profession the whole subject is both a problem and an opportunity.

One of the chief objectives of geriatrics is to study degenerative changes and then to devise methods of eliminating or controlling them. The aging person adapts himself less and less readily to changes. Lack of initiative, mental disorder, and decreased vitality are common among older persons. Too often they are dismissed by the physician as inevitably accompanying old age.

Aging does not progress at the same speed in the various parts of the body nor does it progress at the same rate in all persons. When the cells comprising the body lack adequate amounts of the essential nutrients over sufficiently long periods of time, there is a change in the chemical and biological feats performed within them, and in their physiological functions. From the beginning of life nutrients ebb and flow from the cells into the tissue spaces. Eventually there comes a time when the cells fail to adjust to a depletion of nutrients and a whole train of changes occurs, changes which manifest themselves in many ways. The person becomes troubled and tired; each trivial expenditure of energy must be followed by a long repose; mental processes become overstrained by the most insignificant details. It has been observed that these characteristic changes of aging occur prematurely among the patients in our clinic. There is a need for measuring these changes to learn how much nutrition may influence them.

Concerning the changes associated with a deficiency of the vitamins only faint clues are available, and of their chemical and physiological role almost nothing is known. Yet, from observations on hundreds of persons with vitamin deficiencies over a long period of time, it is evident that the vitamins are in some way essential to nearly all the cells of the body. The physical changes accompanying a deficiency of vitamins are clearly evident in the bones, the teeth, the skin, the muscles, the connective tissues, and the glands.

For the past ten years a study has been made at the Hillman Hospital of the nat-

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This paper is one of the University of Cincinnati Studies in Nutrition at the Hillman Hospital.

The tremendously heavy expenses of the general nutrition study have been borne by grants from a number of philanthropic persons, foundations, and commercial concerns, without which this study could not have been made. The necessary expense of frequent observations of these persons in their homes and in the clinic over a long period of time has been defrayed by grants from the Martha Leland Sherwin Memorial Fund and the Ciba Pharmaceutical Products, Inc.

ural development and course of disease related to nutritional deficiency among persons living in an area in which these conditions are endemic. During this time there has been an unusual opportunity to study nutritional problems in persons of all ages. Whenever a diagnosis of deficiency disease was made in a patient, the nutritional status of each member of the patient's household was ascertained. All members who had any evidence of nutritional deficiency disease were examined regularly over a period of years.

It was soon observed that nutritive failure is common among women of childbearing age. Frequently these women have inadequate diets during pregnancy and lactation. As a result the quality of their breast milk is probably poor, and the supply is often insufficient for the child's needs. The children are usually underweight and underdeveloped for their age and appear to be undernourished and in poor health. They are irritable, easily frightened, and cry a great deal. They often say that they are too tired to play; yet they cannot rest. Many of them complain of vague symptoms such as soreness of the lips, burning and pain in the stomach, and cramping and aching of the feet and legs. As a rule they are listless and apathetic and frequently they appear and act like little old men and women.

Yet in this clinic, it is not among children that nutritive failure is most common, but it is among women during the childbearing period. Furthermore, these women, without exception, appear older than their actual ages. This is our fundamental observation which we cannot quantitate. It should be noted that nutritive failure among men of the same age is less common. In the Hillman Clinic it has been observed also that as men and women reach the age when loss of teeth is common, the number who develop nutritional deficiencies is about the same in both sexes. One explanation of this is that when men and women whose diets have been qualitatively poor become quantitatively inadequate as a result of being unable to chew food properly, they develop diagnostic lesions of nutritive failure. Figure 1 shows the age incidence of white and Negro patients seen in our clinic in 1944. Although the Clinic is located in an area where the population is approximately 50 per cent Negro, it is interesting to note in Figure 1 how many more white patients there are than Negro patients.

In arbitrarily selected patients who had some of the stigmata of so-called old age and also the stigmata of nutritive failure we have observed such significant changes as to warrant reporting them. The present communication is concerned with four representative cases, types of cases which will be seen in any large nutrition clinic.

Case No. 1

Mrs. H. W., a 70-year-old white woman, was brought to the Nutrition Clinic in an

ambulance in June, 1941, in a semicomatose condition. The following history was obtained from her son and daughter-in-law:

Family history was irrelevant.

Marital history: She was the mother of eight children, all living and well.

Past history: Until the onset of the present illness, she had always been in good health. Although a wide variety of foods had been available, she preferred bread, desserts, and sweets to other foods; consequently, she included in her diet very little milk, meat, vegetables, or fruit.

Present illness: Her present illness began about the time of the menopause, which occurred when she was fifty years of age. At this time her son and daughter-in-law with whom she lived noticed that she began to behave in a peculiar way. She seemed afraid of people and often ran to the barn and hid from them. She refused to eat at the table with the family; but when no one was around, she ate in the kitchen and, as far as her family knew, ate only bread, crackers jam, cake, or pie. She aided a little with the housework and with the work in the garden, but she began to stay in bed during the greater part of the day and to prowl around the house most of the night. A physician who was consulted told the family that if she became worse she should be committed to an institution for the insane but that she might gradually get well. He said also that the "breaking out," which her daughter-in-law noticed on the patient's forearms, was pellagra and advised that she be given raw eggs, milk, and an ounce of dry brewers' yeast daily. Soon after this she had all her teeth extracted. Because she refused to use dentures she could not chew solid food, so she ate only raw eggs, milk, cooked cereal, and occasionally drank fruit juice (See Figure 2). Her condition remained essentially unchanged for twenty years except that in the spring her arms "broke out." At these times she had hallucinations. She said that a sister who had died in childhood was calling her. She packed her clothes to go and

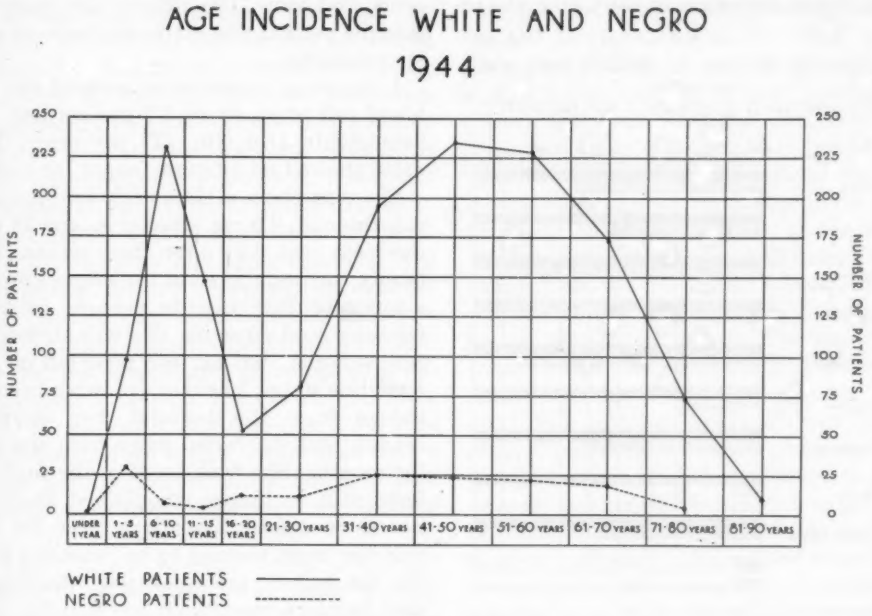

FIG. 1

visit this sister but never left the house. Four weeks before she came to the Clinic, she began having diarrhea—four to six watery, foul-smelling stools daily. About this time she began complaining that her mouth was sore, and she refused all foods except milk. Her daughter-in-law noticed that her tongue was red and that she had "sores" at both angles of her mouth. A week before she came to the Clinic, she refused to bathe because of the pain in her legs. A physician who was called in said that she had pellagra and advised bringing her to the Nutrition Clinic.

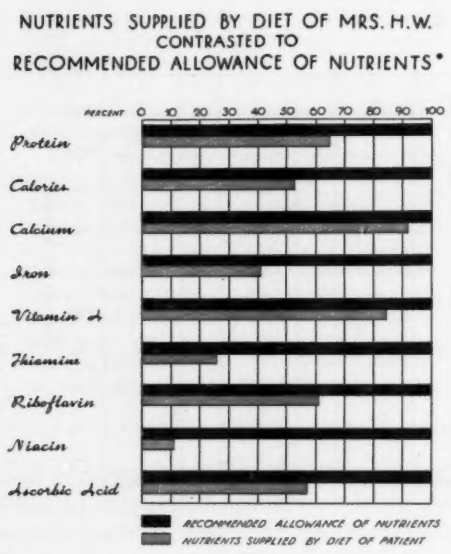

FIG. 2

Physical examination showed a tall, thin white woman weighing 92 pounds. Her normal weight in middle life had been 150 to 160 pounds. The subcutaneous tissues contained little fat. The skin was pale, dry, and atrophic. Typical pellagrous erythema covered the ankles and the dorsum of the feet, and the skin on the forearms was deeply pigmented and beginning to desquamate. There was a macerated area 2½ mm. in diameter at each angle of the mouth. The buccal mucous membranes were moderately reddened. The tongue was edematous and atrophic with many red papillae at the tip. The conjunctivae of both eyes were reddened and the blood vessels dilated. Neurologic examination showed absence of vibratory sense in the legs and excruciating tenderness to pressure in the muscles over the nerve terminals of the legs, feet, forearms, and arms. Throughout the examination the patient was extremely nervous and apprehensive.

Laboratory examination showed the red blood cell count to be 3.2 million and the hemoglobin 11.8 Gm. (77 per cent). The urine showed no albumin, sugar, or casts.

She was given tablets each containing 5 mg. thiamin, 2.5 mg. riboflavin, and 75 mg. nicotinic acid, t.i.d., for three weeks. The family was instructed in the preparation of a semisolid diet high in protein, calories, minerals, and vitamins. She was allowed to return home, and her son reported on her condition daily. The day following her discharge from the hospital, her diarrhea ceased, and she rested more than she had for months. She took most of the food offered and no longer complained that her mouth was sore. Two days later her son said her mind seemed to be "clearing up." By the end of the week she volunteered that her legs were much less painful. Two weeks later when her son brought her to the Clinic, she walked from the car into the building.

The following week she began to help with the housework. She started using her dentures and continued eating a liberal, well-balanced diet. She has had no return of symptoms, and she is active and happy. During the war years she has been carrying the burden of the household duties while her son and daughter-in-law have been working in war industries. This woman, who was a heavy obligation to her family, is now contributing to their happiness and welfare.

CASE NO. 2

Mrs. S. W., a 50-year-old white woman was brought to the Nutrition Clinic in July,

1941, by a social worker from a relief agency which had been aiding the family intermittently since 1928. The patient was confused and unable to give a satisfactory history. The following history was obtained in part from the social worker and in part from the patient after she recovered.

The family consisted of the patient, her husband, and six children ranging in age from seven to twenty-six years. Her husband was a share cropper, and from the time he was a small child he had worked on a farm. He had never attended school. He and Mrs. W. were married when they were both twenty-two years of age. They had no regular cash income, as they worked as share croppers on a small farm. Their diet consisted chiefly of dry beans, biscuit, cornbread, grits, sorghum syrup, and salt pork. Occasionally they had eggs, lean pork, and buttermilk. During the spring and summer they had garden vegetables and wild berries, and they canned some of them for winter use, but their supply of canned food seldom lasted beyond December. In 1928, Mr. W. lost the eyesight in one of his eyes as a result of an injury. Since that time a relief agency had aided the family except during periods when he obtained occasional work in a sawmill or on a farm.

Mrs. W. was in good health until after the birth of her third child, when she lost her appetite and lost weight and strength. The other children were breast fed until they were two years old, but she had so little breast milk she weaned this child when he was five months old. Her health did not improve. Knowing that her teeth were in bad condition and having no money for restorative work, she had them all extracted when she was thirty-six years of age. She could not afford to buy dentures and could not chew solid food; so she restricted her diet to grits and gravy (made with pork fat and flour), cornbread and biscuit which she soaked in coffee, and dried bean soup. The following year her fourth child was born. She nursed him for two months; then her arms "broke out" and she weaned the baby thinking she had some disease which he would "catch." Soon after this she "went crazy" and was committed to a custodial institution for the legally insane, where she stayed six months. When she was discharged, her mind was clear. Following the birth of her fifth and sixth children she developed symptoms similar to, but more severe than, those she had following the birth of the fourth child, and each time she was committed to an institution for the legally insane where she remained for several months. Each spring since that time her mouth became sore, her arms "broke out," and she became extremely nervous, forgetful, and confused. She spent six or eight weeks in bed or shut up in her own room, and refused to allow her husband or children to stay in the room for more than a few minutes at one time.

Three months prior to the time she was brought to the Nutrition Clinic, she developed severe diarrhea which continued for ten days. Her mouth and tongue became so sore she could eat but little food. About this time her arms began to "break out." She told her family she was "plumb crazy," but refused to see a physician or to go to a hospital because they had not "cured" her before. Noises such as the radio or children's voices "make me put my fingers in my ears." She refused to leave the house for fear of becoming too confused to find her way home. She had hallucinations, usually concerned with relatives or friends who were no longer living. She complained of burning of her tongue and corners of her mouth, and also burning of her feet, especially at night. The "craziness in the head" and fear of "going crazy" seemed to be her greatest concern. A social worker brought her to the Clinic.

Physical examination showed an extremely thin, stooped woman who appeared to be between sixty-five and seventy years of age. Her skin was dry and wrinkled, and there was little fat in the subcutaneous tissues. She had pellagrous dermatitis on the skin over her ankles, the dorsum of her hands, arms, cheeks, and forehead, which was deeply pigmented and scaling. Her

tongue was smooth with many reddened papillae at the tip and along the sides. At both angles of her mouth there was a crusted lesion (cheilosis) about 1½ mm. in diameter which she said had been coming and going for several years. The conjunctivae of the eyes were thickened, and the sclerae showed many dilated vessels. (Over and over again she said, "My eyes sting like they have mosquitoes in them.") The knee and ankle jerks were moderately hyperactive, and there was tenderness to pressure over the nerves in the calf muscles.

The clinical impressions were pellagrous dermatitis and glossitis due to niacin deficiency and nutritional peripheral neuritis due to thiamin deficiency. It was undecided as to whether the mental symptoms were the result of thiamin or niacin deficiency or to a simultaneous deficiency of both these vitamins. The appearance of the conjunctivae and the corners of the mouth suggested a riboflavin deficiency.

Fifty mg. of thiamin hydrochloride were administered intravenously at 10:00 a. m. Two hours later she said her head felt "steadier" and she felt "less scary." That night she slept nine hours, and the tenderness of the muscles could no longer be elicited by pressure over the nerves. A total of 20 mg. of thiamin hydrochloride and 500 mg. of niacin amide by mouth was prescribed daily in divided doses, and she was advised to eat a diet high in calories, protein, minerals, and vitamins which the relief organization said they would provide. One week later she came to the Clinic alone by train and street car. She said that she had been given her medicine regularly and that, for the past three days, her mouth had been well enough for her to eat all the food prescribed. She volunteered that her feet no longer burned, that she was sleeping well, and that she felt "clearer headed" than she had since she was a girl. The cheilosis was beginning to heal, and although the sclerae still showed numerous dilated vessels, she said the stinging of her eyes had ceased. The niacin amide and thiamin were discontinued at this time, and she was advised to continue eating the prescribed diet and to come back to the Clinic at monthly intervals. In the past four years she has had no recurrence of symptoms.

The patient said she thought her husband had pellagra, and asked if she could bring him to the Clinic. Examination showed that he had permanent loss of eyesight in one eye and partial loss in the other. The skin on his hands, forearms, ankles, and neck showed residual changes of pellagra. It was decided to see if we could improve his health by giving him vitamins and a good diet. His appetite improved as did his diet, and he gained in weight, strength, and vigor. With the war time need for labor, he was able to obtain regular employment, and the family has been self-supporting ever since. Mrs. W. has been keeping house for herself, the two youngest children, and her husband, and has taken considerable interest in the social activities of the community. Recently she had dentures made and can eat solid food. She has had no recurrence of symptoms.

The preceding two cases illustrate nutritional failure in elderly persons. Following the extraction of their teeth, neither of these patients used dentures. They were unable to eat solid foods and their diets became even more inadequate than they had been. In both these persons nutritive failure had serious effects, fortunately reversible, on the entire family unit.

The following two cases are those of severe nutritive failure in younger persons. In common they both had repeated pregnancies during which their diets were inadequate, and they both aged rapidly and prematurely over a period of a few years. They looked old. Their skin was dry and inelastic and the subcutaneous tissue was dissipated. They had many of the stigmata of old age which, as yet, we cannot quantitate. As their nutritional status improved, their vigor and strength returned. They appeared and felt younger than they had prior to nutritive therapy.

CASE No. 3

Mrs. E. R., a 30-year-old white woman, came to the Nutrition Clinic in June, 1938, complaining of "breaking out" on her ankles, legs, and forearms, and a sore mouth and tongue.

Family history: Irrelevant.

Present illness: Her present illness began in 1935 when she was 27 years of age, two months following the birth of her fourth child. Until this time she considered that her health had been good. Her appetite had always been good, but as long as she could remember she had never liked or used milk or lean meat. Four months before this child was born, her husband lost his job because of the depression and could obtain only occasional work. They could afford to buy little but cornmeal, flour, dried beans, and salt pork. She did not eat much of these foods, however, because "I was too worried to eat." After the baby was born, she was weak and tired all the time, but she nursed this child as she had the other three. Her mouth became sore, and she became very nervous when the baby was four months of age. She could not sleep because she "saw things" and imagined someone was trying to break in the house. About two months after her mouth became sore, her hands and ankles "broke out." A physician prescribed cod liver oil which she took for several months. He also advised her to drink milk and to eat eggs, meat, and green vegetables. She did not drink milk, but she did eat lean meat and green vegetables about twice a week and an egg four or five times a week, in addition to larger amounts of other foods than she had eaten previously. Gradually her health improved, although she regained very little of the 15 pounds of weight she had lost, and she continued to be extremely nervous. During the spring of 1936 and 1937 her symptoms returned and were even more severe than they had been previously. In 1938, during the sixth month of her fifth pregnancy, she became extremely nervous and depressed and threatened suicide. A neighbor became alarmed about her and persuaded her to come to the Nutrition Clinic.

Physical examination showed a tall, emaciated woman weighing only 110 pounds, although she had reached the sixth month of pregnancy. Her usual weight varied between 120 and 125 pounds. Despite the fact that she was only 30 years of age, ten physicians judged her age to be between 45 and 50 years. Her skin was dry, wrinkled, and inelastic (see Figure 3). Characteristic pellagrous skin lesions in the erythematous stage covered the dorsum of her hands and wrists. Her tongue was fiery red, as were the buccal mucous membranes. Both angles of her mouth were macerated. Although she complained of burning of the soles of her feet, especially at night, neurological examination was negative. Dental examination showed extensive and advanced caries and periapical ulcers.

FIG. 3. Pellagrous dermatitis in a woman 30 years of age. The skin was erythematous, dry and wrinkled. Note the excess loss of elasticity.

She was given 500 mg. of niacin daily in divided doses and was instructed to eat a diet which included a quart of milk, 4 eggs, 4 ounces of lean meat, and liberal amounts of green vegetables and fruit. The day after treatment was started, her mouth and tongue were so much better that she had no difficulty in eating all of the food prescribed. Two weeks later she had gained 5 pounds in weight and was eating and sleeping well. Within two weeks the skin lesions on her ankles and hands were desquamating, and the lesions at the angles of

her mouth had healed. A week later the lesions on her hands had healed completely (see Figure 4). The nicotinic acid was discontinued at this time, and she came to the Clinic for observation once a week until the baby was born. She had a normal delivery of a normal child and an adequate supply of breast milk. When the infant was two months old, the family moved away.

E. R. was not seen again until the family returned in 1940. She gave a history of having had all her teeth extracted soon after her last visit to our Clinic. Because the dentures she had made hurt her mouth, she seldom tried to wear them; so she ate only soft foods. The following year she had a miscarriage during the sixth week of pregnancy. Soon after this, her mouth became so sore she limited her diet to soup, cooked cereal, and biscuits soaked in tea. Examination showed a recurrence of all the symptoms she had when we saw her in June, 1938. She was again given a total of 500 mg. of nicotinic acid daily and instructed to eat a diet high in calories, protein, minerals, and vitamins. After a week on this regime, her symptoms disappeared.

FIG. 4. The darker hand is that of the patient in figure 3 taken after 1 week of treatment. Note that the pellagrous dermatitis has disappeared leaving residual pigmentation and skin changes. Contrast the appearance of this hand with the hand of another woman of the same age.

Again the family moved away, but she returned in 1945, when she gave the following history of her health from the time she had last been to the Clinic. In 1944, two months following the birth of her sixth child, who, like the others, was breast fed, she began to "go down hill." She lost all desire for food, lost weight, and her tongue and mouth became sore. Her eyes burned and itched constantly. She became extremely nervous and was unable to sleep at night because of the burning and cramping of her feet and because she "heard voices." In April, 1945, she came to the Nutrition Clinic seeking treatment.

Examination showed intense redness of the tongue and buccal mucous membranes, cracking at both angles of the mouth, injection of the conjunctivae and dilation of the blood vessels of the cornea of both eyes. Neurological examination showed slight tenderness of the calves, moderately hyperactive ankle and knee jerks, a decrease of 20 per cent in vibratory sense in the legs, and hyperesthesia to pinprick in the right leg. Laboratory tests showed no ascorbic acid in the plasma; plasma protein 4.2 per cent; red blood cell count 800,000 and color index 1.4. A. W. Mann, D.D.S., who made a dental examination, found that the alveolar ridge had changed considerably since her dentures were constructed. There was a decrease in the vertical dimension between her jaws as a result of not having worn dentures. He believed this decrease had been a contributory factor in her recurrent cheilosis, and that her inability to masticate food properly had been in part responsible for the inadequacy of her diet. He found also that the mucosa over the upper ridge appeared as if it could support dentures and advised her to get them as soon as possible.

The diagnosis at this time was pellagra, beriberi, riboflavin deficiency, severe macrocytic anemia with achylia gastrica, hypoproteinemia, and ascorbic acid deficiency She was advised to eat a diet high in protein, calories, vitamins, and minerals. She was also given the following: (a) 500 mg. of ascorbic acid and 500 mg. of niacin amide

in divided doses by mouth daily for ten days; (b) 10 mg. of thiamin and 10 mg. of riboflavin b.i.d. by mouth daily for ten days; (c) 20 U.S.P. units of reticulogen intramuscularly for ten days.

On this therapy she improved rapidly. Within a month, she had gained 10 pounds, and her strength and vigor had improved to such an extent that she obtained a position as a clerk in a department store and has worked every day for the past four months. New dentures which have been made give her a different appearance. Her face no longer sags, and she appears younger to her family and friends.

Case No. 4

Mrs. E. J., a 34-year-old white woman, came to the Nutrition Clinic in June, 1939, complaining of weakness, nervousness, soreness of the mouth, and "breaking out" on her arms.

Family history: A sister and an aunt had "died of pellagra." The patient knew none of the details of their illness except that her sister "broke out and went crazy with pellagra" about a year after the birth of her eighth child, and her aunt developed similar symptoms soon after the birth of her tenth child. Both of them died within a year of the onset of their illness.

Past history: Irrelevant.

Present illness: Until 6 months prior to the time she came to the Nutrition Clinic she had been in good health. About this time she began losing her appetite and losing weight and strength. She was married at the age of 15 and had seven children who ranged in age from 3 to 16 years. They had all been breast fed until they were from 12 to 14 months old, and they were all in good health. A year after the birth of the youngest child, she had a miscarriage during the second month of pregnancy. The following year (1938) her husband died. He had worked regularly in a dairy, and although they did not have enough money to buy meat more than once a week, they had a garden and chickens and always had a liberal supply of milk, eggs, and vegetables. Following her husband's death, the only income was from a relief organization. After the rent and utilities were paid, there was only $22.00 a month left for food and clothing for herself and seven children. She moved to a house where the rent was lower, but she had no place for a garden or chickens. There was seldom enough money to buy anything but potatoes, dried beans, grits, cornmeal, flour, and pork fat. Whenever possible she bought milk and vegetables, but she gave them to the children, thinking they needed them more than she did. She began losing weight and strength, and became extremely irritable. The children, to whom she was devoted, "drove me crazy." She was unable to sleep more than two or three hours at night. During the day she worked steadily but seemed to accomplish very little. She could not sit still because of the "jitters" in her legs. She was so forgetful she could not remember what she went to the store to buy, and often made three or four trips a day to buy a few groceries. Two months before she came to the Clinic her tongue and mouth became so sore she could eat little but soup. She began having burning and cramping in her stomach and was certain that she had "cancer of the stomach" and was going to die. Soon after this, her feet began burning so severely at night that she wrapped them in wet towels to try to get relief. A week before she came to the Clinic the skin on her forearms, from the elbows to the wrists, became red. Since some of her symptoms were similar to those of her sister who had "died of pellagra," she came to the Clinic seeking treatment.

Physical examination showed a well-developed but extremely thin woman who weighed 102 pounds in contrast to her usual weight of 135 pounds. She looked considerably more than 34 years old. Her skin was dry and inelastic. Pellagrous erythema extended from her wrists to her elbows. Her tongue was extremely red and swollen, showing the imprint of her teeth along the margins. There was moderate injection of the sclerae and conjunctivae of both eyes. Neurologic examination showed moderate hyperactivity of the ankle jerks and ten-

derness of the calf muscles to deep pressure.

She was given in divided doses 500 mg. of nicotinic acid daily for 10 days; and since the relief agency from which she was receiving help offered to cooperate in helping her get more food, she was instructed to eat a diet high in calories, protein, minerals, and vitamins. When she came to the Clinic two days later, the redness of her tongue and buccal mucous membranes had

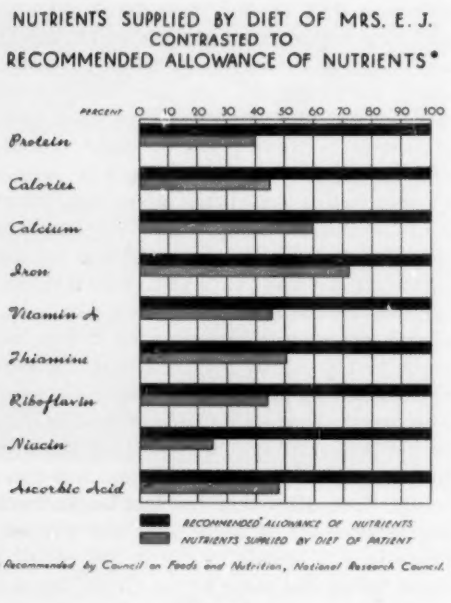

FIG. 5

faded; and she said that her mouth and tongue were less sore, that she was able to eat all the foods prescribed, and that she was sleeping more than she had for months. Three days later the skin lesions on her arms began to desquamate. She was given thiamin 10 mg. b.i.d., and within two weeks the pain in her legs had disappeared and she had gained four pounds in weight. Her health continued to improve. The following year she remarried, and the family moved to another part of the state. Her husband had regular work in a steel mill, and her diet was excellent until she became pregnant the second year of her marriage. During the first two weeks of pregnancy she was nauseated and vomited frequently. During the second month, her husband, who occasionally drank heavily, injured a fellow workman in a brawl and was sentenced to the penitentiary for two years. Once again the family was supported solely by a relief agency. During the greater part of her pregnancy her diet was inadequate, and the last month she was so weak and the pains in her legs were so severe that she spent most of the time in bed. Following the birth of the child, the pains in her legs increased in severity. Her mouth and tongue became so sore she could not brush her teeth and could eat nothing but cooked cereal, mashed potatoes, and soup (figure 5). Despite having only a meager supply of breast milk, she continued to nurse the baby at frequent intervals during the day and night. When he was three months old, she began giving him cooked cereal. When he was six months old, her arms, hands, and forehead "broke out." At this time the baby began refusing to take his cereal, and often cried when she was nursing him. She noticed that his tongue looked red and sore. Thinking he had "caught" pellagra from her, she became so alarmed she asked a social worker from the relief agency which was aiding her to bring her and the baby to the Clinic in April, 1943.

Physical examination showed an extremely undernourished woman who appeared to be at least 20 years older than she did when we had seen her in 1939. Her skin was generally dry, and over the forehead, dorsum of the hands and forearms it was deeply pigmented and scaling. Her tongue was red and swollen. The left angle of her mouth showed slight cracking (cheilosis). Her eyes were sensitive to light, and the conjunctivae were reddened and thickened. Neurologic examination showed excruciating tenderness to pressure over the nerves in both calves and slight diminution in vibratory sense. Examination of the infant was difficult because he cried constantly, but he was obviously extremely pale and undernourished. The tongue was

fiery red at the tip and margin. The mother was given 500 mg. of niacin amide daily, instructed as to what she should eat, and was told to continue to nurse the infant. The following day the reddened area on the baby's tongue had decreased approximately one-third in size. The mother said it was easier to get him to take his food, and that he was sleeping a great deal more than he had been. The mother's mouth and tongue remained unchanged.

Two days later the baby's tongue had healed completely, and he was given orange juice and his formula. At this time the mother's tongue was much less red, and she said that she could eat without discomfort. Both the mother and infant continued to improve. Within two months the baby was normal in weight, and the mother had gained 9 pounds. In the past two years they have had no recurrence of symptoms.

DISCUSSION

It is not possible to be too definite concerning the premature aging which is so prominent among the men, women, and children in this region of endemic malnutrition. Yet, it is so striking that it is commented on by all observers who visit the Clinic. It is true that at some time in their lives, most of the men have worked extremely hard and for many hours daily in the fields, in steel mills, or in mines. Most of the women have been pregnant, lactating, or both throughout many of their childbearing years. In addition to caring for their homes and children, they often work in the fields or do other work outside their homes. Following loss of their teeth many of the patients in the Clinic either do not get dentures, or cannot wear them. This, of course, contributes to their appearance being that of older persons. It also contributes to the inadequacy of their diets in that they often are unable to chew solid foods, and therefore do not eat an adequate diet. These factors may leave a stamp on them. Nevertheless, it is noted that hard working men, women with large families, and children living in more bountiful sections of this country do not display to such a marked degree, the characteristics of premature age that are observed in these patients. Because malnutrition is a common factor in all our patients, and what appears to be premature aging occurs in many of them, it is believed that the effect of nutrition on the aging process is a fertile field for investigation.

SUMMARY

Cases 1 and 2 illustrate that nutritive failure may accompany old age and be considered by the physician as a part of growing old. No one knows what per cent of persons who are told they are growing old have nutritive failure, nor what role nutritive failure plays in the aging process. From these two cases and from others which have been studied, it does seem that an even greater effort should be made to detect nutritive failure among the aged and to apply proper nutritive therapy. These two cases illustrate that gratifying results can be expected to follow specific treatment after a precise diagnosis is made.

Cases 3 and 4 are similar to a great many seen in the Clinic, persons one would judge to be much older than they actually are. Following nutritive therapy these two women appeared much younger than they had prior to treatment.

There is no yardstick for measuring nutritive failure, but it seems certain that the whole field of geriatrics would advance greatly if one were available. Until more scientific methods of measuring the aging process are available, it is well to keep in mind that nutritive failure may cause a person to appear much older than he is.

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ABSTRACT

Various conditions brought on by lack of proper nutrition have been variously judged to be simply a part of growing old, or to have an effect of making a person appear old beyond his years. This is particularly evident in the southern United States, where many people in the lower income brackets must work for long hours every day in the fields, the factories, or in mines. Here women, pregnant during most of their childbearing years, must also spend long hours caring for homes and children as well as working outside their homes. As a result of a study made over a period of ten years at the Nutrition Clinic at Birmingham, Alabama, it was found that nutritional deficiency is most common among women of childbearing age. These women frequently have inadequate diets during pregnancy and as a result both the mother and the child are affected. Of the cases observed at the clinic, most of the women suffered from pellagra, nervousness and hallucinations, sore mouth and tongue, severe pains in the feet and legs, and loss of weight. One woman of 30 was judged by her appearance to be 50. Another who was 70 began again to lead a vigorous and happy life after proper diet and treatment were prescribed. No one knows what role nutritive failure plays in the aging process, but a greater effort should be made to apply what we do know so that older people suffering from lack of proper nutrition may be returned to an active and happy life.

RÉSUMÉ

Les diverses conditions amenées par le manque d'une nutrition convenable ont été souvent jugées comme faisant partie simplement du progrès de la vieillesse et ont souvent pour effet de donner à certaines personnes une apparence bien au delà du nombre de leurs années. Ceci est particulièrement apparent dans le sud des Etats-Unis où les personnes de la classe inférieure doivent travailler de longues heures chaque jour dans les champs, dans les usines, ou dans les mines. Là, les femmes, qui ont des grossesses pendant presque tout le cours des années où elles peuvent concevoir et enfanter, doivent passer de longues heures aux soins du ménage et des enfants, aussi bien que travailler en dehors de la maison. Une étude faite sur une période de dix ans à la clinique de nutrition de Birmingham, Alabama, a eu pour résultat de démontrer que l'insuffisance de nutrition est la plus commune, parmi les femmes, dans la periode où elles peuvent concevoir et enfanter. Ces femmes, très fréquemment, ont un régime insuffisant pendant leurs grossesses, le résultat étant que la mère et l'enfant sont tous deux affectés. Dans les cas observés à la clinique, la plupart des femmes souffraient de pellagre, nervosité, et hallucinations, de plaies de la bouche et de la langue, de violentes douleurs dans les jambes et dans les pieds et d'une perte de poids. Une femme de 30 ans paraissait en avoir 50. Une autre qui en avait 70 recommença à mener une vie heureuse et vigoureuse après la prescription d'un régime et d'un traitement convenables. Personne ne sait quel rôle l'insuffisance nutritive joue dans le progrès de la vieillesse, mais un plus grand effort devrait être fait pour appliquer ce que nous savons de manière à ce que les personnes âgées qui souffrent d'un manque de nutrition convenable puissent être ramenées à une vie active et heureuse.

SUMARIO

Las diferentes condiciones ocasionadas por la falta de una adecuada nutrición han sido juzgadas de distintos modos: como si fuera simple parte del proceso de envejecer, o como si tuviera el efecto de hacer aparentar a una persona más años de los que tiene. Esto es particularmente evidente en el sur de los Estados Unidos, en donde, durante la época de bajos ingresos, mucha gente trabajó muchas y largas horas cada día en el campo, las fábricas o las minas. Aquí las mujeres, preñadas durante casi todos sus años de fecundidad, debían gastar largas horas en los cuidados del hogar, así como también en trabajos fuera de él. Como resultado de un estudio hecho en un período de diez años en la Clínica de Nutrición de Birmingham, Alabama, se encontró que la deficiencia en la nutrición es más frecuente entre mujeres en edad de tener hijos. Estas mujeres tienen con frecuencia una dieta inadecuada durante la preñez, y como resultado, tanto el niño como la madre resultan afectados. De los casos observados en la clínica, la mayoría de las mujeres sufrían de pelagra, nerviosidad y alucinaciones, llagas en la boca y lengua, agudos dolores en los pies y piernas, y pérdida de peso. A una mujer de treinta (30) años de edad se la juzgó por de 50. Otra mujer que tenía 70 años comenzó de nuevo a vivir una vida vigorosa y feliz después de que una dieta y tratamiento adecuados le fueron prescritos. Nadie sabe qué papel juega la mala nutrición en el proceso de envejecimiento, pero debería hacerse un mayor esfuerzo por aplicar lo que realmente conocemos, a fin de que la gente vieja que sufre de falta de nutrición adecuada pueda volver a vivir una vida activa y feliz.

СВОДКА

Разные явления, вызванные неправильным питанием, приписывались иногда наступлению старости, между тем как неправильное питание старит человека. Это особенно заметно на юге Соединенных Штатов, где люди при низкой оплате труда проводят длинные рабочие дни на полях, фабриках и в шахтах. В этих районах женщины, почти постоянно беременные в течение всего периода их способности к деторождению, должны не только вести хозяйство и заботиться о детях, но и работать вне дома. В результате наблюдений, производимых в течение 10 лет в Клинике по диетике в гор. Бирмингам, штата Алабама, было установлено, что болезни вызванные недостатком питания встречаются чаще всего среди женщин в периоде жизни, когда они способны к деторождению. Эти женщины часто во время беременности не имеют достаточного питания и это отражается и на матери, и на ребенке. Большинство женщин, прошедших через Клинику, страдали пеллагрой, нервностью и галлюцинациями, воспалением рта и языка, сильными болями в ногах и теряли в весе. Одна 30-летняя женщина выглядела как 50-летняя. Женщина 70-ти лет, после того как ей дано было правильное питание и необходимое лечение, стала вести нормальный образ жизни и почувствовала себя счастливой. Еще не выяснено какую роль неправильное питание играет в процессе постарения, но мы должны сделать все возможное для использования того, что мы уже знаем, чтобы дать старикам, страдающим от неправильного питания, возможность вернуться к деятельной и счастливой жизни.

A SOFT OR A HARD *G*

In general the *g* before *a*, *o*, or *u* is pronounced as a hard *g*; before a short *i* (*y*) or *e* as *j*; and before a long *i* (*y*) or *e* either as hard *g* or *j* depending on the word. However there are many exceptions to these three general rules. Usage and the rule coincide with the word "geronology," and hence it is:

je-ron-tol'-o-je

Prolongation of Life with Prevention of Leukemia by Thymectomy in Mice

JACOB FURTH

IN EXPERIMENTS WITH MICE OF A HIGH LEUKEMIA STRAIN, (AK), DR. FURTH HAS SHOWN THAT REMOVAL OF THE THYMUS AT SIX WEEKS OF AGE HAS THE EFFECT OF PROLONGING LIFE AND OF DECREASING THE INCIDENCE OF LEUKEMIA IN MICE FROM 80.8 PER CENT TO 9.9 PER CENT. THESE EFFECTS OF THYMECTOMY ARE PROBABLY DUE TO REMOVAL OF POTENTIALLY MALIGNANT CELLS CONTAINED IN THE THYMUS. PROLONGATION OF LIFE IS BROUGHT ABOUT BY REMOVAL OF AN ORGAN WITH GREAT HEREDITARY LIABILITY TO A FATAL NEOPLASM, AND SUSCEPTIBILITIES TO OTHER NEOPLASMS WITH LONGER PERIODS OF LATENCY ARE THUS DISCLOSED.

IN THE COURSE of studies on the genesis of spontaneous leukemia it was observed that thymectomy at about six weeks of age in a high leukemia strain of mice (Ak) caused a conspicuous prolongation of life of most of the experimental animals, and a decrease of the leukemia incidence from 69 to 9.5 per cent (1).

Experiments were undertaken to verify this observation and to investigate the possible mechanism whereby thymectomy reduces the leukemia incidence. The original series was composed of 86 thymectomized mice; the second series of 133 mice.

METHODS

All mice used in these experiments were of the high leukemia strain Ak, the origin and characteristics of which have been described (2). The thymus was removed at an age of approximately 6 weeks. The operative technique used was essentially the same as that described by Segaloff for the rat (3). The controls were non-thymectomized members of the same strain kept in the laboratory until natural death during the course of the thymectomy experiments. The mortality curve and leukemia incidence in these control mice are essentially the same as in other groups of this strain analyzed during the past ten years.

All mice were autopsied but microscopic examination was made only when the autopsy findings left doubt as to the presence or type of leukemia. At autopsy care was taken to ascertain the absence of the thymus and identify the surgical wound. Two thymectomized mice were still alive at 21 and 22 months of age. These were charted with the negatives.

RESULTS

The effect of thymectomy on the incidence of leukemia and on the life span of mice is summarized in Table 1. The incidence of leukemia in relation to age is

TABLE 1. EFFECT OF THYMECTOMY ON INCIDENCE OF LEUKEMIA AND LIFE SPAN OF MICE

	Thymectomized		Control	
	Females	Males	Females	Males
Number in Group	102	117	112	145
Intercurrent death below six months of age*	1	10	5	14
% developing leukemia	10.8%	9.0%	83.5%	78.2%
Mean age of life in months	13.6	14.4	9.5	9.7

* In calculating leukemia incidence these were discounted from the total.

Dr. Jacob Furth, professor of pathology, Cornell University Medical College, and associate pathologist, New York Hospital, received his M.D. in 1921 from the German University, Prague. Dr. Furth came to America in 1924 and held positions at the Rockefeller Institute and the Henry Phipps Institute in Philadelphia before going to Cornell in 1932.

This investigation has been supported by The International Cancer Research Foundation, The Jane Coffin Childs Memorial Fund for Medical Research, The Anna Fuller Fund, and The Lady Tata Memorial Trust.

Miss M. C. Boon and Miss K. Cobbs rendered skillful technical assistance in the course of these experiments.

shown in Chart 1 and the mortality in Chart 3.

Chart 1 shows that most normal mice of the Ak strain die, usually of leukemia, before the age of 12 months. The mode of mortality is at 8 months for females and 9 months for males. These mice seldom reach the age of 17 months, although in the present series, three of the 257 normal mice died at an age of 19 months. In contrast to these, numerous thymectomized mice were older than 20 months at death, the oldest dying at the age of 24 months. Even during the first few months of life mortality from causes other than leukemia was slightly higher among the normal mice than among the thymectomized, though the difference does not appear significant. The mean age of death of the thymectomized mice was 14 months, and of the normals 9.6 months—an increase in the life span of almost one-half.

In our earlier studies no special attention was given to the nutritional state of thymectomized mice and the question arose whether or not some of the effects of thymectomy were not due to a nutritional deficiency. The second series of mice were weighed intermittently with this possibility in mind and it became evident that thymectomy does not result in a loss of body weight; and on inspection the experimental and control mice appeared indistinguishable.

The Type of Leukemias in Thymectomized

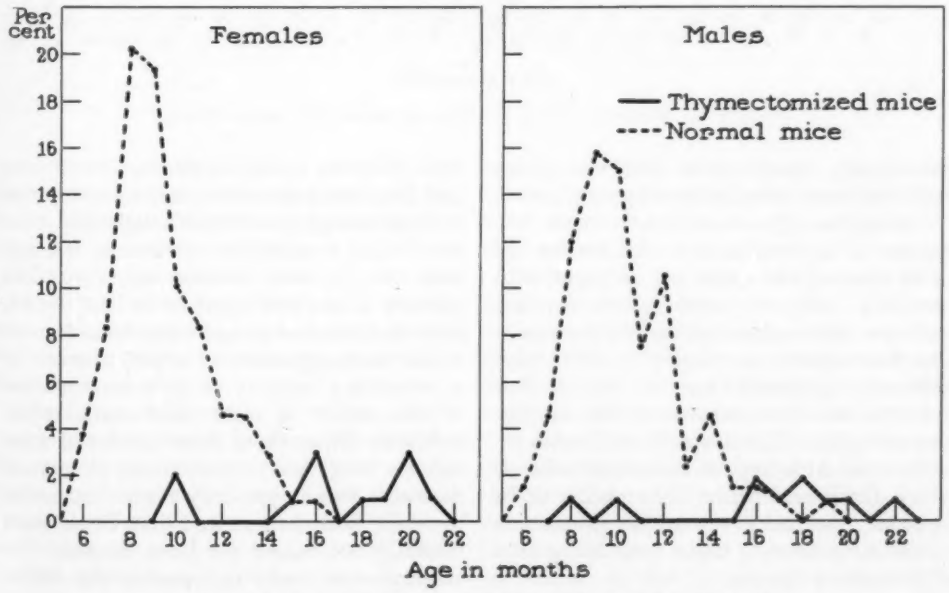

CHART I. Leukemia incidence in thymectomized and normal mice.

Mice. The leukemias in normal Ak mice dying at 7–12 months of age were predominantly lymphoid. Occasional cases of myeloid leukemia have been noted in this strain but no monocytic leukemia. Chart 1 indicated that most leukemias in thymectomized mice occurred at a later age and that most of these leukemias were different from the typical lymphoid leukemias that are monotonously alike in young normal Ak mice. The superficial lymph nodes were often but slightly enlarged or not enlarged, the thoracic nodes often seemed free from the disease while the mesenteric nodes were are susceptible to leukemias other than lymphoid, which are masked in normal mice by early death from lymphoid leukemia. Whether these leukemias are caused by predominantly genetic or predominantly environmental factors remains to be determined. It is also uncertain whether the absence of the thymus per se or the prolongation of life is responsible for the development of these leukemias; the latter seems to be the more likely supposition.

Incidence of Osteomata in Relation to Age. On autopsy of thymectomized Ak mice that died at an advanced age, osteomata

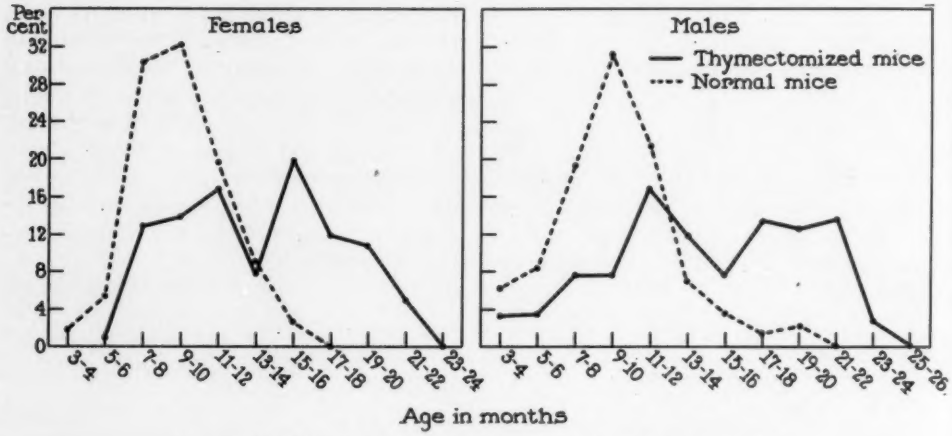

CHART II. Mortality curve of thymectomized and normal mice.

particularly conspicuous, and the spleen and liver were usually greatly enlarged.

On microscopic examination most leukemias in thymectomized mice turned out to be unusual and could not be typed with certainty. Only two were typical myeloid and one was typical monocytic leukemia. One was myeloid or monocytic. Five were definitely lymphoid but in two it was doubtful whether removal of the thymus was complete. The atypical leukemias included two with large mononuclear cells (4) which Lewis and Mider (5) consider to be myeloid; one had a tumor-like granuloma in the subcutaneous tissue resembling that of Hodgkin's disease.

These observations reveal that Ak mice were found in varied locations. The femora and iliac bones were the most common sites of these benign growths although they were also found attached to vertebrae, humeri, and ribs. It soon became apparent that because of the prolongation of life, the Ak mice had reached an age when bone tumors made their appearance, either because of a hereditary liability or as a consequence of the action of some mild carcinogenic influence. Since these bone tumors of mice can be very easily overlooked, it seemed desirable to analyze only recent autopsies in which both femora and iliac bones were carefully examined for bone tumors. No attempt was made to examine the entire skeleton.

Table 2 shows that osteoma is a disease of old mice. The earliest age at which it was noted was 13 months. After 18 months of age 87.5 per cent of all female and 60.9 per cent of all male mice had osteoma. Non-thymectomized Ak mice rarely reach this age but if they do they seem just as liable to develop osteoma as thymectomized mice.

In 31 mice these tumors occurred singly; in 11 mice two tumors were found, in 2 mice, three tumors, and in 1 mouse more than three tumors were noted. But as already indicated there was no attempt to examine the entire skeleton.

The tumors were small, sharply circumscribed, white and ivory hard; only in five mice did their size exceed 5 mm. Their microscopic character and pathogenesis remain to be studied.

The Effect of Thymectomy on the Induction of Leukemia and Tumors. The following experiment was undertaken to determine whether the presence of the thymus has any effect on the induction of leukemia and tumors by methylcholanthrene.

First generation hybrids between low leukemia strain female and high leukemia strain male mice were used in this study. Earlier experiments had shown that in these hybrids the incidence of leukemia is low (3–11 per cent), and that the disease appears late in life. Nevertheless these hybrids are highly susceptible to the leukemogenic action of methylcholanthrene (6).

The animals were painted with 0.5% solution of methylcholanthrene in benzene twice weekly for five weeks. Alternate sites were painted to minimize the development of skin tumors. The experiment was terminated 12 months after painting when the surviving four non-thymectomized and 7 thymectomized mice were killed.

Thirty-eight F1 mice whose thymuses were removed and forty normal siblings were "painted" with methylcholanthrene. The painting was intense; and many mice developed cutaneous or breast tumors and a larger number, pulmonary adenomata (Table 3). The skin, breast, and lung tumors were almost invariably multiple. The skin tumors were usually squamous cell carcinomas or sarcomas, the breast tumors adenocarcinomas and the lung tumors adenomas. It has not been possible to determine on gross examination or by

TABLE 2. INCIDENCE OF OSTEOMA IN AK MICE IN RELATION TO AGE

Age in months	Thymectomized						Normal					
	♀		♂		Total		♀		♂		Total	
	+	−	+	−	+	−	+	−	+	−	+	−
2–4								7		16		23
5–6								14		9		23
7–8								12		8		20
9–10								13		6		18
11–12								8		1		9
13–14		4				4	1	5		3	1	8
15–16		2	1		1	2	1	4	1	3	2	7
17–18	4	3	4	6	8	9	3		1	2	4	2
19–20	9		4	4	13	4	1	1	3	1	4	2
21–22	4	1	4	4	8	5			1		1	
over 22			1		1				1		1	
Total	17	10	14	14	31	24	6	64	7	49	13	112
Total—older than 13 mo.					31	22					13	16
Total—older than 15 mo.					31	20					12	5

TABLE 3. INCIDENCE OF LEUKEMIA AND TUMORS IN THYMECTOMIZED AND NORMAL MICE FOLLOWING PAINTING WITH METHYLCHOLANTHRENE

Mice	Number in group	Tumors		Leukemia	
		Skin and breast	Lung	+	−
Thymectomized	38	25 (65.7%)	35 (92.1%)	5 (13.1%)	33
Normal	40	17 (42.5%)	30 (75.0%)	14 (35.0%)	26

routine microscopic examination whether the superficial tumors originated in the skin, in the dermal appendages or in the breast, and for this reason these are grouped together.

Table 3 shows that following exposure to methylcholanthrene, fewer thymectomized mice developed leukemia than did their normal siblings; but the induction of lung and skin tumors was not influenced by the presence of the thymus.

Actually the incidence of lung and cutaneous tumors was greater in the thymectomized group than in the controls. This difference can be accounted for by the early death of many control mice from induced leukemia as shown in Table 4. The induction period of leukemia is usually less than that of skin and breast tumors.

At the end of 4½ months, five control and but one thymectomized mice had died of leukemia. None had cutaneous or breast tumors, but one of the control mice also had lung tumors.

These experiments are best interpreted by assuming that the thymic lymphocytes of these mice are particularly susceptible to a leukemic change and that lymphoid tissues elsewhere and other blood forming organs are less susceptible to the leukemogenic action of methylcholanthrene. The type of leukemia in thymectomized mice in relation to those induced in normal mice remains to be studied.

All mice killed at the termination of the experiment (12 months) had numerous lung tumors scattered throughout all lobes, and there appeared to be no difference in the size and number of these tumors in thymectomized and non-thymectomized animals. The two non-thymectomized mice, which did not have breast tumors, weighed together 47.4 grams while two representative thymectomized mice weighed 57.6 grams. The subcutaneous fat was more abundant in the thymectomized mice than in the controls. In the latter, each lobe of the thymus measured approximately 7–8 mm. in greatest diameter. It is known that the thymus persists in mice during maturity, and it appears that a marked involution of this organ is caused not by age but by such accidental factors as infection or intoxication.

DISCUSSION

Experiments already described (7) indicate that the effect of thymectomy is not

TABLE 4. INCIDENCE OF LEUKEMIA IN THYMECTOMIZED AND CONTROL MICE AFTER PAINTING WITH METHYLCHOLANTHRENE

Interval* in months	Thymectomized Mice	Control Mice
2½	1 (no tumor)	3 (no tumors)
3½	0	1 (no tumor)
4½	0	1 (lung tumor)
5½	2 (lung tumors)	4 (one with lung tumor)
6½	1 (breast tumor)	3 (2 breast, 1 lung)
7½	1 (lung tumor)	1 (lung tumor)
9½	0	1 (lung tumor)

* Interval between first application of methylcholanthrene and death from leukemia.

inherited, offspring of thymectomized mice having as high an incidence of leukemia as their normal grandparents.

It has also been shown (7) that the growth of leukemic cells is not influenced by the presence of the thymus. In these experiments cells from myeloid or lymphoid leukemias were grafted on thymectomized and normal animals. The course of illness was the same in thymectomized and normal animals.

The data here presented are best interpreted by assuming that the thymus in the high leukemia strain studied contains potentially malignant cells and by its removal the animals are spared from leukemia which is likely to originate in this organ when the mice are seven to eleven months old. They also indicate that lymphoid tissues of these mice present in other locations are not likely to become neoplastic under normal conditions. The leukemogen, methylcholanthrene, seems to render neoplastic, thymic as well as other lymphocytes, and following removal of the thymus fewer animals subjected to this chemical develop leukemia.

Thus the life of the animals is greatly prolonged by preventing early death from lymphoid leukemia for which they have a high hereditary liability, and they reach an age when other neoplasms with longer periods of latency become manifest. These include leukemias of different types which are fatal but appear in small numbers only, and osteomata which are seldom of the size and location to initiate a fatal disturbance.

Absence of the thymus seems to interfere in no way with the health of the animals, which weigh about as much as their normal siblings and do not seem to be more susceptible to common laboratory infections (e.g. pneumonia).

If the interpretation given is correct, thymectomy will not prevent leukemia in mice in which the disease is not thymic in origin and it will have no effect on the length of life of mice not susceptible to lymphomatous neoplasms arising in the thymus. There are data not in full harmony with this interpretation. In Rf/Ak mice the incidence of spontaneous leukemia is about 3–11 per cent. Following application of methylcholanthrene 35.0 per cent of these mice developed leukemia within 12 months as compared to 13.1 per cent of the thymectomized mice similarly treated; the induction rate of breast and lung tumors being the same in the two groups. These results may be explained by supposing that the hemopoietic organ predominantly attacked by this leukemogen is the thymus even in strains in which this organ is not likely to become the site of a spontaneous lymphomatous neoplasm.

Thus far we have failed to demonstrate by means more direct than thymectomy the malignant potentialities of the thymus in Ak mice. Bioassays described elsewhere (7) indicate that even in high leukemia strain mice no malignant cells are present in the thymus during the first few months of life. Thymuses of this high leukemia strain (Ak) mice were grafted on fifty low leukemia strain (Rf/Ak) mice. Theoretically such grafts should take in every mouse. However, the grafts have involuted and none of the low leukemia stock (Rf/Ak) mice developed leukemia within fourteen months of receipt of the grafts of Ak thymuses.

All of these data considered together with those indicating that underfeeding inhibits spontaneous leukemia (8) suggests the hypothesis that the development of leukemia in genetically high leukemia strain mice is brought about by two factors: (a) the inheritance of cells in the thymus with high hereditary susceptibility to a leukemogen, and (b) transformation of these cells to a malignant cell by exogenous or endogenous substances to which the cells are exposed during the normal life of the animals. That extrinsic agents modify the incidence of leukemia in high leukemia strains is known (2); the present observations suggest however that the second factor or sets of factors are far more important than hitherto suspected and

minimize the theory which views hereditary neoplasms in the light of abiotrophies. The nursing influence (2) is probably related to the second set of factors.

These studies can serve as a model whereby the body benefits by removal of a useless organ which appeared inoccuous until analysed. While these observations are not directly applicable to any known situation in man it deserves emphasis that many neoplasms in human beings arise in organs that have survived their usefulness (e.g. uterus or breast), or in tissue rests which have never served any purpose. Removal of such organs would remove the potential menace from a neoplasm but because of the small liability of an individual to develop a neoplasm of a given organ, such procedures are not feasible. However, it is conceivable to neutralize all proliferative activity in some organ with no harm to the host. Using the thymus as a model, such experiments are in progress.

Summary

Removal of the thymus in a high leukemia strain, performed at six weeks of age, raised the mean length of life in females from 9.5 to 13.6 months and in males from 9.7 to 14.4 months. At the same time the leukemia incidence had decreased in females from 83.5 per cent to 10.8 per cent, in males from 78.2 per cent to 9.0 per cent. The evidence presented suggests that the prolongation of life was brought about by prevention of death from leukemia.

Almost all leukemias occurring in the normal mice of this strain are lymphoid and develop at 7–11 months of age while most of the leukemias occurring in thymectomized mice are atypical, myeloid, or monocytic and occur at a later age. This is explained by assuming that prolongation of life by thymectomy brought the mice in the age group in which neoplasms with a longer period of latency became manifest.

Earlier experiments indicated that this effect of thymectomy is not inherited and that the growth of grafted malignant lymphocytes or myelocytes is not influenced by the thymus. Experiments here reported indicate that antecedent thymectomy does not influence the induction of cutaneous or lung tumors by methylcholanthrene while causing a reduction in the incidence of leukemia inducible by this hydrocarbon.

Prolongation of life disclosed the high susceptibility of the mice of this strain to osteoma. These were not noted in mice under 12 months of age but occurred in about 87 per cent of the female and 61 per cent of the male mice living longer than 18 months.

These effects of thymectomy are probably due to the removal of potentially malignant cells. They are presented as examples of how prolongation of life can be brought about by removal of a useless organ with great hereditary liability to a fatal neoplasm and how prolongation of life discloses high susceptibility to neoplasms with long periods of latency.

References

1. McEndy, D. P., M. C. Boon, and J. Furth, "On the Role of Thymus, Spleen and Gonads in the Development of Leukemia in a High-Leukemia Stock of Mice," *Cancer Research*, 4: 377–383, 1944.
2. Furth, J., "Recent Experimental Studies on Leukemia," *Physiol. Rev.*, In print.
3. Segaloff, A., *The Rat in Laboratory Investigation* (Griffith, J. Q., Jr., and Ferris, E. J., editors). Philadelphia, Lippincott, 1942, pp. 388–389.
4. Barnes, W. A., and J. Furth, "A Transmissible Leukemia in Mice with Atypical Cells," *Am. J. Cancer*, 30: 75–94, 1937.
5. Lewis, M. R., and G. B. Mider, "The Identification of Cells from Induced and Spontaneous Leukoses in Dilute Brown Mice," *J. Nat. Cancer Inst.*, 2: 115–122, 1941.
6. Furth, J., and W. A. Barnes, "Differences Between Malignant Blood Cells from Induced and Spontaneous Leukemia of Mice," *Cancer Research*, 1: 17–22, 1941.
7. Furth, J., and M. C. Boon, *The Time and Site of Origin of the Leukemic Cell*, AAAS Cancer Symposium, 1945. In print.
8. Saxton, J. A., Jr., M. C. Boon, and J. Furth, "Observations on the Inhibition of Development of Spontaneous Leukemia in Mice by Underfeeding," *Cancer Research*, 4: 401–409, 1944.

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ABSTRACT

In experiments with mice of a high leukemia strain, (Ak), bred over a period of years, it has been shown that the removal of the thymus has the effect of prolonging life and of decreasing the incidence of leukemia from 80.8 per cent to 9.9 per cent. Thymectomy was performed at about six weeks of age on 219 mice. The controls were non-thymectomized members of the same strain kept in the laboratory, until natural death during the course of the experiments. The leukemias in normal Ak mice dying at 7–12 months are predominantly lymphoid. However, in thymectomized mice, leukemias occurred at a later age and were of unusual types. These observations revealed that Ak mice are susceptible to leukemias other than lymphoid, which are masked in normal mice by early death from lymphoid leukemia. The thymectomized mice frequently had osteomas of the long bones. The data are best interpreted by assuming that the thymus contains potentially malignant cells, and by removal, the animal is spared from leukemia, and thus life is prolonged. Hence, the mice reach an age when other neoplasms with longer periods of latency become manifest. While these observations are not directly applicable to man, it is known that many neoplasms arise from organs which have survived their usefulness. However, such operations obviously are not feasible in man.

RÉSUMÉ

Il a été demontré, dans des expériences faites sur des souris à haute tendance de leucémie (AK) que l'enlèvement du thymus a l'effet de prolonger la vie et de diminuer l'incidence de leucémie de 80,8 pour cent à 9,9 pour cent. La thymectomie fut accomplie à l'âge d'environ six semaines sur 219 souris. Le contrôle se fit par des membres non-thymectomisés de la même tendance, conservés au laboratoire jusqu'à leur mort naturelle, au cours des expériences. Les leucémies dans les souris AK qui meurent quand elles ont de sept a douze mois sont en grande partie lymphoides. Cependent, chez les souris thymectomisées les leucémies surviennent à un âge plus avancé et sont d'un type peu commun. Ces observations révèlent que les souris AK sont susceptibles aux leucémies autres que lymphoides, qui sont masquées chez les souris normales par une mort prématurée provenant de la leucémie lymphoide. Les souris thymectomisées avaient fréquemment des osteomies des os longs. Les données sont interprétées de leur mieux en assumant que le thymus contient des cellules potentiellement virulentes qui, si elles sont enlevées, empêchent l'apparition des leucémies chez l'animal, et par conséquent sa vie est prolongée. De là, les souris atteignent un âge dans lequel d'autres néoplasmes avec de plus longues périodes d'inactivité se manifestent. Bien que ces observations ne soient pas directement appliquables à l'homme, il est reconnu que beaucoup de néoplasmes viennent d'organes qui ont survécu leur utilité. Pourtant ces opérations ne sont évidemment pas praticables sur l'homme.

SUMARIO

En experimentos que se extendieron sobre un período de varios años, con ratones que adolecían de leukemia aguda, Ak, ha quedado demostrado que la extracción de la glándula Thymus, tiene el efecto de prolongar la vida y reducir la incidencia de la leukemia desde 80.8 por ciento a 9.9 por ciento. La "thymectomía" fue ejecutada en 219 ratones de seis semanas de edad, más o menos. Sirvieron de control o punto de comparación, ratones no "timectomizados," de igual índice de leukemia y conservados en el laboratorio durante todo el curso de los experimentos, hasta que muri-

eron de muerte natural. El tipo de leukemia en ratones normales del índice Ak, que mueren entre los 7 y 12 meses es predominantemente linfoide. En cambio, en ratones "thymectomizados" (a los cuales se ha extraido la glándula Thymus) la leukemia se desarrolló a una edad más avanzada y fue siempre de tipos raros, desacostumbrados. Estas observaciones revelaron que los ratones de índice de leukemia Ak, son susceptibles de padecer no sólo la leukemia linfoide sino, además, las de otros tipos, las cuales no llegan a desarrollarse en ratones normales, debido a su temprana muerte por leukemia linfoide. Los ratones thymectomizados padecen con frecuencia de osteomas de los huesos largos. Los resultados de estos experimentos se interpretan mejor presumiendo que la glándula Thymus contiene células potencialmente malignas, removiendo las cuales, el animal escapa a la leukemia y prolonga así la vida. De aquí que los ratones vivan hasta que otros neoplasmas con más largos períodos de latencia se manifiestan. Aunque estas observaciones no son aplicables directamente al hombre, es sabido que muchos neoplasmas proceden de órganos que han sobrevivido a su utilidad. Sin embargo, tales operaciones no son practicables en el hombre.

СВОДКА

Опыты над мышами породы Ак, страдающими лейкомией, выращиваемыми в течение многих лет, показали, что удаление тимоса ведет к продлению жизни и сокращению случаев заболевания лейкомией с 80,8% до 9,9%. Удаление тимоса было произведено на шестой неделе жизни 219 мышам. Контрольной группой явились мыши того же штамма, но не подвергнутые операции. Они находились в лаборатории в течение периода опытов до тех пор, пока они не умирали естественной смертью. Лейкомия в нормальных мышах породы Ак, умирающих в возрасте от 7 до 12 месяцев, главным образом лимфоидная. Однако, у мышей подвергнутых операции, лейкомия появлялась в более старшем возрасте и более редкого типа. Наблюдения показали, что мыши Ак предрасположены к лейкомии также и иных типов, чем лимфоидная. Однако, другие типы часто не бывают опознаны в нормальных мышах, ввиду их ранней смерти от лимфоидной лейкомии. У оперированных мышей часто появляется остеома длинных костей. Эти данные можно объяснить предположением, что тимос содержит в себе потенциально-злокачественные клетки и что удалением тимоса предотвращена лейкомия, и жизнь мыши продлена. Таким образом, мыши достигают более преклонного возраста, когда обнаруживаются иные неоплазмы, развивающиеся более медленно. Хотя эти наблюдения и не относятся непосредственно к человеку, все-же известно, что многие неоплазмы развиваются в органах, переживших свое назначение. Однако, такие операции, конечно, невозможны у людей.

DO YOU KNOW?

A claimant for benefits under Old-Age and Survivors' Insurance, if dissatisfied with the ruling of the Bureau, may appeal for:

1. **Reconsideration by the Bureau of Old-Age and Survivors' Insurance (not later than six months after original decision);**
2. **Hearing before a referee (not later than six months after original decision);**
3. **Review by an Appeals Council in Washington (not later than thirty days after mailing of referee's decision);**
4. **Civil suit in the Federal Courts (not later than sixty days after mailing of decision of the Appeals Council).**

The Hodson Community Center: An Experiment in Preservation of Personality

DORA FUCHS AND HARRY LEVINE

THE HODSON COMMUNITY CENTER OF NEW YORK, THE ONLY ONE OF ITS KIND IN A CITY WITH 500,000 PEOPLE OVER THE AGE OF 65 YEARS, HAS BEGUN SOMETHING NEW IN DEALING WITH THE VARIOUS PROBLEMS OF OLD PEOPLE. IT IS A CLUB WHERE PEOPLE, REGARDLESS OF BACKGROUND, WHO HAVE FEW FRIENDS AND DISINTERESTED FAMILIES, MAY COME TO FIND THE COMPANIONSHIP AND INTEREST SO MANY OVER 65 LACK. HERE THEY HAVE A CHANCE FOR CONTINUED USE AND EXPRESSION OF THEIR SKILLS AND TALENTS WHICH IN TURN GIVE THEM A FEELING OF ADEQUACY, SECURITY, AND USEFULNESS IN THEIR COMMUNITY.

SOCIETY'S relation with the older person seems to be geared toward his final disintegration and inevitable institutionalization, despite the fact that facilities to accommodate him are completely inadequate. The sum total of old age homes in New York City, both public and private, has room with crowding for only 12,000 people. The chaotic result has been that many who need institutional care today cannot secure it, and on the other hand, many who can function effectively outside of the institution take up much needed space there.

Fantastic as it may seem, when the Hodson Community Center for old people was started in September, 1943, it was the only example of its kind in a city where there were more than 500,000 people over the age of 65.

At the time that the New York City Welfare Department organized the Hodson Center, there was a recognition that the solution in caring for old people was not in the direction of more old age homes. It was hoped that with adequate preventive care, medical and psychological, the need for hospitals and institutions could be reduced. The period of dependency might be shortened, thus making possible continued usefuless, dignity, and self respect of the unwanted, complaining, ill at ease, and continuously larger group of older persons in the community.

It was in this spirit and with this understanding that the Hodson Community Center, named in honor of the late William Hodson, Welfare Department Commissioner, was begun in an unused public building in the East Bronx. The local Welfare Department staff voluntarily painted walls, washed woodwork, and arranged furniture in its spare time. Most of the furnishings were contributed by the staff. The Federal Art Project lent pictures. The Welfare Department contributed a piano, some sofas, and some chairs.

Three hundred and fifty people jammed the Center on opening day, listened when it was explained that this was their club for their enjoyment, planning, and participation, asked if they could come again. They have been meeting ever since. One hundred and fifty people attend regularly—men and women of varying racial backgrounds, demonstrating almost another experiment, one in living democracy. People from 70 to 90 come five times a week. The Center is open to all older people in the community. No one needs to account for his politics or income. The common denominator is age and the companionship people give each other.

The Center was introduced as a social club where the older person could come and talk, play cards, read newspapers, or listen to the radio, and have tea, coffee, and cake every day. It has become what even the staff did not presume to expect in so short a time.

When the Museum of Modern Art in

Harry Levine, founder of the Hodson Community Center, has been with the New York City Welfare Department for fourteen years. At present he is welfare administrator of the Manhattan Office. A graduate of Union University and New York Law School, Mr. Levine has been in social work for the past twenty-three years.

Dora Fuchs has been with the New York City Welfare Department for over ten years —in the positions of intake interviewer, supervisory aide, and social investigator. At present she is a field worker in the Bronx Office with a case load consisting mainly of people over sixty-five years of age. Miss Fuchs worked previously as a teacher for the New York City Board of Education, leader of a creative writing group in a settlement house, and a free lance fiction writer. She holds a B.A. degree from Hunter College and an M.A. from Columbia University.

New York hung the paintings of 71 year old Morris Hirshfield two years ago and informed the public that they were the first, untutored attempts of a man who had spent his life in the tailoring trade, critics exulted with the wonder of it. The staff of the Center takes for granted the equally artistic oils and water colors and charcoal sketches on the walls. They are the natural, visual expression of those 65 to 88 year olds who are interested in developing a medium or talent they had never explored. A teacher was supplied when an interest in art was expressed. But of greater significance the Center has given warm companionship, a recognition of their individuality as persons, and an understanding of their need for activity that will provide a feeling of adequacy and accomplishment, of usefulness and belonging.

The forms of expression at the Hodson Center are as varied as the pattern of living. The important contribution is in freeing the personality so that it can express itself in its own way. What has been achieved is a healthy striving toward fulfilment.

A four-piece musical ensemble makes authentic chamber music. It allows, as Professor Curt Sachs, chairman of the New York chapter of the American Musicological Society, has put it, for the participation of non-professional players and the particular delight that they derive from playing rather than from mere listening and from the mutual understanding of the players. It emerged out of the security and appreciation the Center was giving these music lovers who had discarded their love as unwanted.

The warmth of the audience has encouraged performances. Carl Sandburg may have toured the country to collect the indigenous folk songs of America but one 84 year-old gentleman who loves to sing knows a few that Mr. Sandburg has missed.

Justice Holmes made some of his most lucid and erudite decisions when he was past 80. Goethe wrote the last act of Faust when he was 90. Cesar Franck was in his eighties when he gave the world his D minor symphony. There is no such genius—not even potentially—operating in the Center. There is, however, a knowledge that age need not be a deterrent to activity, and we have been able to prove our theory.

Members write and mimeograph a magazine once a month, conduct bi-weekly poetry reading sessions, participate in an English and Citizenship course, refurbish toys for hospitals and nurseries, prepare afghans and baby clothes for the American Red Cross, and make socks and recreational puzzles for the Maritime Service and utility bags for a veterans' hospital. They build household furniture in a carpentry class, speak their mind at lectures about current problems, national and international, and hold discussions on the psychological and physical difficulties of older people.

The people who come have a lessening of physical energy, a separation, physical or emotional, from family and friends, and a loss of occupation. These are changes which need not be confusing or destructive. There have been developed areas of adequacy and superiority which do not cease to exist after the sixty-fifth birthday, and an understanding to give security.

Activity has been substituted for fears and obsessions about aches and pains. Members who used to make a frustrating project out of clinic visits say gaily that they have no time to worry about themselves, and besides, they "feel perfectly fine." Members who complained that their arthritic condition was so bad they could not even use their fingers to write their names are now participating in arts and crafts. The newer thinking in psychosomatic medicine supports the program. It is being recognized more and more widely that physical ailments cannot be separated from their psychological components.

In its own day to day experiences, the Welfare Department staff had discovered that most older people do not have close relatives with whom they could live. Where there were children, the kind of compatibility which makes living together possible was not often found. Differences in religious or cultural observances sometimes interfered, or perhaps it was the older person's resistance to the new in his children's way of living. Or more simply, there was often no room for him either in the small city apartment or in the compact life of younger family relationships. For the most part, the older person, widowed or unmarried, was living alone in a furnished room. He had outlived some of his friends. Others had moved away. Traveling was not easy. Neither was making new friends.

More fundamental in the plan was the knowledge that the older person had a lifetime of experience, understanding, and skills to offer. If these assets that only years can give were channelized in programs that were meaningful and important to the older person, the positive and creative in his personality would be nourished. And by so doing, the community around the old person would be a richer and more vital one.

The means of channelization were known. Give the older person something to do that has significance for him and he is given back some of the dignity of his being. Give him an opportunity to express his old skills or to learn new ones and some of his feeling of adequacy is returned to him. Utilize him in community projects and he has again a healthy sense of belonging in the world.

Interest and friendship have been substituted for the crotchety complaints, the quarrels with landladies, the recurring dissatisfactions with hospitals, public assistance services, and the world in general. The older person is still prone to seek sympathy. Trained group leaders are ready to give individual counseling. As the person becomes more assured, more involved in activities, however, the number of his problems tends to decrease and his capacity to cope with them securely, improves. In what essentially amounts to a rediscovery of himself, he is able to relate himself to people and events, to a positive use of himself as an integral, creative part of his times.

The psychologically well-oriented person is able to go out and meet the community on its own terms. Industry has discovered that recently. The Hudson Motor Company has advertised for workers up to the age of 98. Ford employs men of 70 and over. More than 50,000 people past the age of 65 have given up Social Security benefits and gone back to work since Pearl Harbor. On a less competitive level, the older person has worked efficiently in war agencies, settlement houses, hospitals, and parks. He has trimmed hedges, packed bandages, talked to the blind, and read to the lonely.

Whether or not aged labor can be absorbed profitably in our post-war economic world is rather an unimportant question at a time when the country is debating the matter of sixty million jobs for younger people. What is important is the happiness, the integration, and the continued usefulness of so great a part of our populace.

Millions are spent yearly in health and public assistance programs for the older person. He remains an unproductive, disgruntled being, a continuing drain on the facilities of our clinics, hospitals, and institutions. How much wiser the spending would be if we planned with perspective,

if we worked toward developing the strengths of the older person, enabling him to participate as an emotionally healthy creative member of his community.

The work being done at the Center is a microscopic sampling in the realization of what are infinite areas of human competency. Most of us have always thought of our skills in terms of our specialized work habits. There has been little time for the exploration of other talents or facets of our personalities. And when life seems to stop suddenly with retirement at 40, we are sterile, abandoned human beings. No wonder we are old at 60, thinking of death rather than life at 70. If a man could learn that productive life can continue on a broader, far more inclusive scale than existed within the previous job definitions, organizations like the Hodson Community Center would become centers of expression, enriching the happiness and cultures of communities.

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ABSTRACT

On opening day in September, 1943, 350 people jammed the Hodson Community Center, the only one of its kind in a city where there were more than 500,000 people over the age of 65. The center was introduced as a club where people could come and talk, play cards, read, listen to the radio, and have tea and cake every day. Its one common denominator is older people regardless of racial background, income, or politics. The center gives art lessons for those interested, holds bi-weekly poetry reading sessions, has music ensembles, and conducts English and citizenship classes. Members make baby clothes for the Red Cross, socks and utility bags for the Maritime Service, and refurbish toys for hospitals and nurseries. There are lectures on current problems and on the difficulties that older people have to meet. The whole idea of the center is to give older people, many of whom have few friends and disinterested families, a place to go, a new interest in using their skills and talents, and to help give them a feeling of adequacy and security and continued usefulness in their community.

RÉSUMÉ

Le jour de l'ouverture, en Septembre 1943, 350 personnes remplissaient le Hodson Community Center, le seul centre de ce genre, dans une ville ou se trouvent plus de 500.000 personnes âgées de plus de soixante-cinq ans.

Le Centre fut presenté comme un club ou l'on pourrait venir converser, jouer aux cartes, lire, écouter la T.S.F., et prendre du thé et des gâteaux chaque jour. Son commun dénominateur est l'âge des personnes intéressées sans aucune différence de race, de fortune ou de politique.

Le Centre offre des leçons de dessin et de peinture pour ceux qui s'y intéressent, des lectures de poésie deux fois par semaine, de la musique d'ensemble et dirige des cours d'anglais et d'instruction civique. Les membres du Centre confectionnent des layettes pour la Croix Rouge, des chaussettes et des sacs-nécessaires pour le Service Maritime et réparent des jouets pour les hôpitaux et les crèches. Il y a aussi des conférences sur les problèmes d'actualité et les difficultés que les personnes âgées rencontrent dans le cours de leur existence.

l'idée principale du Centre est de donner aux personnes âgées, dont beaucoup ont peu d'amis et peu d'intérêt de famille, un endroit où elles peuvent se rendre, un nouvel intérêt pour l'emploi de leurs facultés et de leurs talents, et de les aider à conserver une sensation de compétence, de sécurité, et d'utilité à la communauté.

SUMARIO

El día de su inauguración, Septiembre de 1943, trescientas cincuenta personas se apretujaron en el "Hodson Comunity Center," el único en su clase en una ciudad con más de quinientas mil personas mayores de sesenticinco años.

En centro fue presentado como un club a donde la gente podría venir a conversar, jugar cartas, leer, oír radio y disfrutar de te y dulces cada día. Asiste comunmente gente vieja, sin distingos raciales, políticos ni económicos.

El centro da lecciones de arte a los interesados, mantiene sesiones de lectura de poesías dos veces a la semana, tiene programas de música, y ofrece clases de Inglés y de civismo. Los miembros del club hacen ropa de niños para la Cruz Roja, medias y sacos o talegas para el Servicio Marítimo y retocan juguetes para hospitales y casas de niños. Se dan, además, charlas sobre problemas corrientes así como también sobre las posibles dificultades a que los viejos tienen que enfrentarse.

El propósito real del centro es dar a la gente vieja, muchos de los cuales tienen pocos amigos y parientes que no se interesan por ellos, un sitio a donde ir, nuevo interés en usar sus habilidades y talentos, ayudarles a experimentar sentimientos de seguridad y suficiencia, y que además se consideren a sí mismos útiles en su comunidad.

СВОДКА

В сентябре 1943 года 350 человек собрались в Ходсонском коммунальном клубе. Это единственный в своем роде клуб в городе, где свыше 500.000 жителей старше 65 лет.

Клуб был открыт для того, чтобы дать возможность членам его собираться ежедневно, беседовать, играть в карты, читать, слушать радио и пить чай с печением. Членом клуба может стать каждый человек, независимо от расы, экономического положения и политического мировозрения. Единственное условие, которому должны отвечать члены клуба — это возрастный ценз.

Желающие могут слушать в клубе лекции по искусству, посещать концерты и устраиваемые дважды в месяц вечера чтения стихов и литературных произведений, при клубе имеются классы английского языка и курсы по подготовке членов клуба для получения гражданства. Члены клуба шьют детские платья для Красного Креста, вяжут носки и другие вещи для моряков, а также занимаются починкой игрушек для детских ясел и больниц. В клубе также бывают лекции по текущим вопросам и обсуждаются проблемы, встречающиеся в жизни стариков.

Цель клуба дать возможность старым людям, которые в большинстве случаев не имеют близких друзей, и семьи которых ими не интересуются, собираться, проявлять свои способности и освежать свои знания. Это дает им чувство уверенности в себе и в том, что они все еще являются полезными членами общества.

QUIZ ON THE SOCIAL SECURITY LAW

Which of the following types of employment are covered by the present law on old-age and survivors insurance?

1. Self-employment
2. Office work
3. Factory work
4. Casual labor
5. Domestic service
6. Building construction
7. Student nurse
8. Work in cafeterias
9. Work in commercial fisheries
10. Work in banks
11. Newsboy under 18 years of age

Answers on page 95.

Budgeting for Social Security

W. R. WILLIAMSON

THE PRESENT SOCIAL SECURITY PROGRAM IN THE UNITED STATES IS ACCUSED BY MANY OF ITS OPPONENTS OF BEING THE CAMEL'S HEAD UNDER THE TENT FLAP LEADING US INTO SOCIALISM. ON THE CONTRARY, BUDGETING FOR SOCIAL SECURITY IS AN OVERALL ARRANGEMENT FOR A FLOOR OF PROTECTION ONLY. AN ADEQUATE GOVERNMENT PROGRAM IN THE UNITED STATES WILL NOT BE THE COMPLETE ANSWER BUT SHOULD BE BUTTRESSED AND REINFORCED BY PRIVATE GROUP INSURANCE, RETIREMENT PLANS, AND INDIVIDUAL THRIFT. IT WILL ALSO PROVIDE ASSISTANCE FOR CASES OF PARTICULARLY HIGH LIVING COSTS OR SERIOUS NEEDS.

I. Social Security

With the final surrender of the Japanese, current security from military attack seems effective for the American citizens. It is an appropriate time to consider anew that other security called "social"—the security that Beveridge calls "Freedom from Want."

The phrase "social security" is a newer name for that series of benefits in cash and in services long called "social insurance." There is a dash of imagination in the selection of the terms "social insurance" and "social security." When the term was "insurance" it suggested those qualities of insurance called "responsibility," "dependability," "financial integrity," "sensible budgeting for presumptive needs." Insurance, however, deals with so many presumptive needs and involves such a multiplicity of methods of approach, that after the first psychological value of the phrase, the word "insurance" possibly creates more disagreement than agreement as to what it means in this context. Probably the major reason for this disagreement is that life insurance, with its high premium and cash surrender values is a technical combination of current and deferred protection, with so careful an accounting of the policyholders' equity in the deferred protection that insurance is frequently regarded as savings. Social insurance similar to that aspect of life insurance and annuities has created trust funds. The individual share in these trust funds, and in general the relative individual equities among the members have created much discussion.

"Economic Security" was used as a tentative designation by the Committee on Economic Security, appointed by President Roosevelt in 1934, for the study of a practical organization of an American program of social insurance. Apparently "*social* security" caught the imagination of Congress more than did "*economic* security" and the legislation of 1935 seems to have fixed the terminology throughout the world. New Zealand called its 1938 program "social security." Beveridge chose this phrase in 1942. Further discussions in Europe, Asia, and South America continue the use of "social security," apparently combining those connotations of dependability which went with insurance, with the further qualities of cooperation and social welfare suggested by the word "social." "Social security" is then a relatively new phrase for a long-standing recognition of serious presumptive human needs. Once recognized by a nation, "social security" seems to hold a persistent appeal for the citizens.

The Beveridge Report was a best-seller in England and ran high in the United States. He called "social security" "Freedom from Want." The "want" to which he refers is not absolute, but presumptive. From Queen Elizabeth's time onward, the Anglo-Saxon world has intended that no one should starve, be naked, or shelterless. After 300 years, what first seemed the humanitarianism of relief given by the charitable with needs tests varying in their indignity, has grown steadily more unacceptable to the citizens. "Freedom from

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The views expressed by Mr. Williamson are not necessarily the official views of the Social Security Board.

want," in the poorhouse, on the charity rolls, in the penal institution, has furnished food, raiment, shelter. It has also carried a rather bitter stigma. Such charity emphasized the fact that these people had failed in their personal budgeting. They have required rescue by the community after the harm has been done. Today's emphasis in social security programs is upon the elimination of needs tests. Benefits are to be given as a right, available in the case of presumptive need. When we merely substitute the less searching needs test for a more searching one, and when we find those persons actually in need and administer to their needs, we carry into the new program the stigma accompanying the old. We do more. We appeal to the cupidity of the individual. We break down the sense of personal pride and personal responsibility. We create difficult choices for citizens between maintaining a rugged self-reliance on very limited funds, or accepting the bread of charity. When the man receiving assistance has as much or more than many an individual persisting in his "freedom from charity" we tend to discourage the exercise of prudent foresight and responsibility.

The way to escape from this dilemma is to provide for benefits for all based upon presumptive rather than actual need, and to add currently to the large number who are beneficiaries because their need is actual the larger group of persons who do not essentially need the benefit in the sense that without it they would starve. Social budgeting may seem, then, an expensive luxury. Dissatisfied with the results of the petty economy which isolates the failures and the unfortunates, it counts upon the cooperation of all citizens to assume freely a preliminary doubling or tripling in the volume of income payments. It provides an over-all floor of protection through budgeting, replacing the use of wide variance in the amounts of benefit, which necessarily follows detailed casework with individual investigation into exact personal requirements. Budgeting substitutes the less accurate evaluation of presumptive need for the more accurate evaluation of actual need. It may then require a supplementation by public assistance in cases of exceptional need.

Beveridge's championship of this budgeting is the natural evolution from nearly forty years of cautious, thoughtful, responsible experimentation within the British Isles. As he says, these programs are not programs that are *given*. They are programs that are adopted by a people for itself. They are programs that are inherently evidence of their cooperatioeness, their self-reliance, and their sense of responsibility, their acceptance of the wisdom of a realistic approach to life—the substitution of a tough-minded accounting for a negative attitude stressing inability to meet responsibility. They assume strong family ties among the generations.

II. The Catastrophic Presumptive Needs

The treatment of three personal catastrophic needs:

(1) Jobless old age;
(2) Disability of long standing;
(3) Dependency of family survivors after the death of the breadwinner

is the area where the pooling services of social insurance seems most valuable. A retired man of 70 may live a decade. A mid-

dle-aged person, blinded in an explosion, failing to adapt himself to his new handicap, may live for three decades. The orphan child of 2 or 3 years may expect a dozen years before our modern society allows him to go to work. Such long-continued periods of presumptive dependency require thousands of dollars for bare support. These are situations where individual budgeting is well guided into pooled, or cooperative provision. A man does not know whether he will survive to such an age as 70, or die first. He does not know the presumptive duration of his individual after-lifetime should he survive. The injured, or otherwise disabled person can rarely make a personal diagnosis as to the severity of his disability, or its probable duration. The young man establishing a family is in doubt as to the future size of his family, whether he will die and leave orphans, or outlive the period of his children's dependency.

We have, in dealing with these situations, many existing facilities outside of governmental programs. There are deferred annuities for the provision of an income in old age, "permanent total disability" insurance to be available in event of long-continued disability, life insurance in many varieties. There are group insurance and other employer plans. There are many others. The common denominator of these insurances and annuities is cooperation, responsibility in purpose and administration. We have in these programs a wide range in amounts of protection to fit the varying needs and desires of the insured lives. They reinforce social budgeting.

III. The Lesser Misfortunes and the Services

Included within social security handling are two presumptive needs: (1) Temporary joblessness; (2) Temporary disability, markedly different from the three catastrophic needs of jobless old age, invalidity, and dependent family survivors. The average duration of the absence from work in either unemployment or temporary disability is reckoned in weeks or months, rather than in years; and most citizens, in the absence of social security, have been accustomed to the accumulation of certain personal reserves designed to tide them over such temporary emergencies. Outside of social insurance, unemployment benefits have been developed only rarely by certain experimenting employers. Temporary disability protection, however, has been commonly offered by nongovernmental organizations, such as Mutual Benefit Associations, Friendly Societies, Health and Accident Insurance Companies, Blue Cross Hospitalization plans and the Group Departments of both the Life and the Casualty Companies. Even as life insurance has a wide range of separate contracts, so disability insurance furnishes many special services. There are arrangements for the payment of compensation for the loss of time; provisions to indemnify the individual for the expenses of hospitalization, surgical expenditures, specialists' and general practitioners' fees, the costs of appliances and drugs, the costs of nursing and dentistry. Combining in its coverage the loss of income and the extra expense, budgeting is very appealing here also.

While all the catastrophic and noncatastrophic needs so far discussed involve cash benefits, there are also benefits in kind potentially available within social security operations There are specific services or "utilities." We could have the actual furnishing of medical care by an insuring organization or by the Government itself, in lieu of cash indemnity paid to the individual. There are the specially desirable services of physical rehabilitation, vocational rehabilitation, basic training, and job placement. There are broad measures of over-all sanitation and prevention of epidemics to be added to the sphere of social services.

The catalog of potential benefits may be only an objective toward which the community is moving. It may represent services currently in operation. Most social security programs are closer to the former than to the latter; they have a quality of

delayed effectiveness. Thus, the American program of old-age benefits of 1935 planned to pay no old-age benefits until 1942. The 1939 Amendments moved up the date of first payments to 1940. The revised program adopted an insured status, setting up new hurdles, so that in 1945, out of more than seventy million persons with a record of having made some contributions to the program, over thirty million are not insured. There are many consequences of this policy of delay, of this partial ineffectiveness. They create a protesting attitude of mind among the citizens who seem to be discriminated against, much like that of the critic of personal budgeting who says that it bars an individual from desired expenditures.

IV. Budgeting for Social Security

Budgeting for social security is a realistic, accounting-minded, responsible tool for society to use. It is an attempt to force a choice between certain benefits, and by certain allocation of our funds to see that those choices become actually effective. It attempts to count the cost, but to secure promptly the benefit of a budgeting process.

Personal budgeting takes account of stock. A man in a low-earning bracket has no right to live as though he were in a high-earning bracket. As Micawber outlined budgeting, it really involves having a margin of income over outgo. It calls for a tough-mindedness in this world of so wide a range of personal satisfactions. Only the very wealthy can have them all. If we are basically honest, the rest of us must fit our expenditure pattern to our income. We must recognize the possibility of certain types of contingency, and we must allocate some of our funds to these contingencies, as well as to the current satisfactions. Many a person has found great satisfaction in making these choices and year-by-year consistently following his own plan. The man with the $2,000 income who lives as though he had a $5,000 income is headed for trouble. He may become actually dishonest. He may engage in sharp practices. He may go bankrupt. Particularly for the low income person budgeting is imperative. Moreover, frequently adequate consideration of his limited choice among goods and services stimulates him to higher earning power, so that he may have a larger share of current satisfactions.

Employers organize welfare plans for their employees. They try to grasp their financial significance. When they establish life, disability, or retirement plans, they think in terms of a balance sheet.

Similarly, when Government assumes the responsibility of guiding its citizens into a self-respecting social security program, Government must budget for that program. It must study seriously the potential immediate and deferred costs. It must acquire full familiarity with the financial relations entailed. Budgeting for social security assumes the purpose of paying benefits to those categories of persons having presumptive needs.

The rest of this discussion is largely limited to budgeting for those three catastrophic situations of:

(1) Jobless old age;
(2) Long-duration disability;
(3) Orphaned childhood and widowed motherhood.

It does not deny the potential wisdom of other fields, but it prefers to consider these more catastrophic situations alone. Social security must inevitably fit the country which adopts it. Programs of certain European nations have been in harmony with the extreme emphasis upon the over-all authority of the State. In the United States, where the pioneering spirit still remains, there is a vitality in engineering direction, a vigor in management policy which teams up social security with other security measures. These together can be tabulated as:

(1) Social security arrangements for floors of protection, financed by the working citizens of the Nation;
(2) Employer and Mutual Benefit Asso-

ciation plans for group handling of life insurance, disability insurance, and group annuity contracts (such plans representing the ability of leading employers of America to supplement base wages by furnishing a framework for, and a contribution toward, benefits in addition to the governmental floor);

(3) The natural personal provision of individual thrift and voluntary insurance not tied in with employment by a common employer, not limited to a lowest common denominator of benefits administered by Government, but providing a range and scope of action to its citizens, dominated by a strong sense of personal responsibility and evidencing a real effectiveness in handling personal problems.

Thus, social security plans for America should require a smaller proportion of the national income than in the historically important plans of the Central European governments. Because the individual capacities of the American citizens and the national resources are both at a high level, most American citizens wish to meet their own major responsibilities themselves. There are other reasons why benefits should be kept low. Most benefits are payable because of unemployment. Unemployment is a catastrophic situation. When benefits for the catastrophic situation are too high, men seem tempted into the catastrophe. The administration of invalidity insurance in Germany illustrates the abuses following from too high benefit levels and conditions not conducive to high employment. We should avoid the less desirable features of Germany's experience.

The Central European programs, with their overemphasis upon the power of the State, tended to absorb too much of the properly complementary plans of employers and individuals. They tended to determine benefits by earnings class and to develop a rather stratified system. It would seem more in accordance with our democratic tradition to provide the same cash benefits for all and to recognize that the capacity to earn higher wages also means a capacity to develop more personal provisions for oneself. The wider range of nongovernmental facilities in the United States presumably results in reducing the extent to which Government must function.

The backgrounds to social security are numerous. Since so many different agencies give benefits in both actual and presumptive need, social security is bound to be explained in terms of relief, of insurance, of savings and investment, of family solidarity, of tax policy, of employer-employee relations, in terms of Federal-State relations. We even find explanation in terms of employer-pension programs. It is well to understand the functions which each of these organizations has in common with social security. It is equally important that the recognition of certain common values should not lead to a mental transfer of functions and qualities truly belonging to one agency over to social security where they are not necessarily appropriate. Social security is not essentially savings. It is not a structure of relief. It does not carry the elements of vested right so important to many a pension plan. It is closer to assessment insurance than to ordinary or old-line insurance. It is perhaps only satisfactory on a truly current-cost basis.

Current cost is sometimes used in a positive, sometimes in a negative sense. In this discussion it is used in a positive sense. It refers to the current assumption of costs involved in providing a floor of protection for all current beneficiaries. It should not be a form of denial of current benefits to today's beneficiaries, while implying that posterity will provide full protection for the beneficiaries of its time.

Properly budgeted, social security requires neither open, nor veiled subsidies. Our civic consciousness strongly requires a current sense of footing the bill for today's social security as it does in connection with schools and roads and public buildings. The

old New England town meeting made no attempt to hide the basic aggregate of governmental costs. It attempted to make a fair allocation of these costs among all the taxpayers of the community, and to arrange that if a person seemed temporarily unable to meet his share of the cost in cash that he should work out his taxes on the road, or in some other community responsibility. In modern America, with its nominally voluntary contributions to Community Chests, the Red Cross, Federal bond purchase, etc., we emphasize the privilege we have of making contributions on behalf of the common welfare.

In the use of pay-roll deduction as a method of paying Federal income taxes, of meeting the purchase price of Federal bonds, of contributing as employees toward pension plans and insurance, we have an effective budgeting technique. Having determined to meet certain bills, we get cooperation from the employer in collecting the funds for the payment of these bills at the source. That technique is available for special earmarked taxes for social security in respect to the large majority of the working citizens of America. Those in self-employment may accept the slightly greater responsibility of paying their own social security taxes without pay-roll deduction. It goes with the extra privilege of self-employment, as against working for someone else.

While New Zealand has used a uniform percentage against pay-roll and other income without any such maximum as our $3,000, and beyond that collects largely from general taxation, the meeting of the costs of the three major catastrophic needs seem best handled by a single uniform percentage tax upon the citizen for the first $3,000, or the first $5,000 of earnings. Great Britain has stressed a flat contribution rate against all citizens, and then determines it so low that two subsidies are required, one from the employer, one from the Exchequer. The basic flat contribution is expected to meet only one-fourth of the cost. Provided we escape the awkwardness of the limitation of the flat dollar contribution, there seems no sound reason for taxing the employer. When he is generally taxed, the tax can be explained as a basic increase in wage. In such a case, the worker should have the privilege of claiming that he personally pays the tax from his adjusted wage. The tripartite contribution, with its two subsidies, as in England, created the psychologically bad slogan "a shilling for thrupence." We have said that social security is not savings. It is well to admit that it can come to serve part of the purposes of savings. If the program is sufficiently rational, it will have great powers of persistence. Citizens will come to count upon its availability in the event of potential catastrophe. It is still well to maintain the current benefit viewpoint; to recognize that the only way the contributors will get "their money's worth" is to develop so equitable a program for today that future taxpayers will be ready to continue it in operation. There is a sound suspicion against a perpetuity—today's lawmakers should not be able to force today's remedies into use against the maladies of tomorrow.

This discussion is an emphasis upon the wisdom of budgeting for the responsibilities which we understand, and of budgeting to meet today's necessities rather than tomorrow's. If we claim credit for certain guidance to posterity, it is well to follow that guidance ourselves in connection with today's problems. This effectiveness alone is social budgeting.

V. Specific Budgets for the Three Catastrophes

1. *Jobless Old Age*

In 1945 we have ten million individuals aged 65 and over within the continental limits of the United States. By the end of the century we expect to have twice this number. In the OASI program, mainly outlining the benefits of tomorrow, 65 is the youngest age at which an old-age benefit may become payable. The simple qual-

ifications for an old-age grant in our budgeting program might be:

(a) The attainment of age 65;
(b) The absence of gainful employment;
(c) Being the non-working wife of a non-working employee.

The absence of gainful employment is sometimes admitted as indicated by a current monthly income from wages or salary of less than $25. The Bureau of the Census, in its inquiries of 1940 and in its periodic reports on the extent of the labor force, has led to the belief that there are 6,500,000 persons aged 65 and over who are neither gainfully employed, nor the wives of those gainfully employed. This brings in two viewpoints:

(a) That the wife is normally supported by her husband;
(b) That she must also be at least age 65 to qualify for benefits.

Our information as to the rates of pay among many of these older persons at work is slight. Our information as to the permanence of their employment is also largely missing. We are dealing with the situation following the successive catastrophes of a major depression, a critical recession, the calamity of the war. Our figures in this report are largely illustrative. They merely help to give a sense of balance between a national working force of from fifty-five million to sixty-five million persons and three classes of non-working individuals. Perhaps the number of potential aged beneficiaries may lie between six million and seven million persons per year. The recommendation of this paper as to the level of benefits in old age is to adopt the payment of $25 per month per person, or $300 per year. This would give $50 a month for an aged couple where both lives are aged sixty-five or over.

In spite of the dislocations of the war, in spite of the fact that most of us giving consideration to these subjects live in big cities and under urban conditions, it can be said that $300 a year is not far from the national average being paid under old-age assistance, where a certain tendency is developing to keep the benefits in one State as high as the benefits in another State. Further, the $300 is not offered as a subsistence level of support, but rather as a floor of protection which seems to be a little high in Southern and even in Northern rural locations. Urban dwellers not only have higher living costs, but also much better facilities for savings than do rural residents. The virtual universality of payroll deduction for bond purchase has resulted in a major part of the community achieving a new personal provision for future needs. It has in advance reinforced any social budgeting program developed. Moreover corporations or employers increasingly carry group insurance, or salary allotment programs.

The $300 yearly benefit represents 15 per cent of what has recently been about the average per capita earnings of about $2,000. On a somewhat traditional assumption of 1½ dependents—a little high now—the $2,000 earned income would represent an $800 per capita income. Three hundred dollars out of $800 is probably a fair recognition of the part of the national income representing minimum subsistence in a national budgeting program. For six or seven million aged beneficiaries the annual budget might respectively be $1,800 million, or $2,100 million. This against a national taxable wage bill of perhaps $100 billion (a reduction from the war level) would run about 2 per cent; while a drastic further cut of one-third in the national wage bill might increase the relation of benefits to wages to as much as 3 per cent.

Looking forward toward the end of the century, with double the number of persons aged 65 and over, there can either be an increase in the proportion lacking work, a maintenance of the proportion lacking work, or a decrease in the proportion lacking work. Moreover, over the years, the wage bill is very apt to climb so that benefit levels may be advanced in accordance therewith. It is possible that in spite of the

larger base against which to measure the benefits, the impact of meeting the cost might rise to as much as 3 per cent or 4 per cent by the end of the century.

While these are tremendous sums in the aggregate, our recent familiarity with the much more tremendous sums involved in the war keep these amounts from seeming of considerable relative magnitude. Moreover, thoughtful pension proposals under consideration by employers involve annual expenditures ranging from 10 per cent to 15 per cent of the individual pay roll. Percentages ranging from 2 per cent to 4 per cent are, therefore, relatively modest.

It is the old-age portion of these social security measures which has particular significance in our psychological attitude toward the aging process. Pension plans developed by the employers have perhaps, on the whole, been directed more toward the function of house-cleaning for the advantage of the employer than toward the important psychological values to the aging employee himself. Men must, after retirement, have significant employments of some sort. A social security program emphasizing the granting of benefits in the absence of any paying job has a quite different viewpoint from pension benefits paid a man as a deferred wage available at the time of the loss of a particular job. If we reach a capacity for wiser use of our manpower at advanced ages in the absence of disability, and if we maintain the limitation that only the jobless receive benefits, we may find a further credit in costs. If the more awkward viewpoint sometimes voiced by organized labor that the competition for jobs must be reduced by eliminating the older man from the labor market, and if technological unemployment grows, costs could be even higher than 4 per cent.

Changes in population, changes in community attitudes, changes in technology, changes in migration are all component elements in the trends of future outlay under social budgeting. They are also present in any social security program for the aged, including those starting with very small benefit payments. Social budgeting minimizes the rate of growth by adopting the payment of more initial benefits and possibly through this practical arrangement discarding such devices as the rate of increase of 1 per cent a year of contribution now utilized in old-age and survivors insurance. This OASI program bids fair to go to twenty to thirty times today's expenditures, while under social budgeting it might only go to twice its initial expenditures.

Canada is considering a slight variation from this social budgeting method in determining age pensions of $30 a month for all aged 70 or over, with benefits on the basis of a needs test as assistance for those aged 65 to 69. The majority of men and women aged 70 and over are already through work, so that the addition of those who have not terminated work might increase the beneficiary list by 15 per cent to 25 per cent. By adopting this simplification, we would save the psychological problem sometimes presented when we seem to deny the citizens the right to work by shutting off their benefits when they go back to work. There could well be an advantage in using as the criterion for benefits presumptive old-age retirement and paying benefits to every aged person, encouraging to the maximum the continuation of work relationships as long as possible. By setting the age at 70 rather than 65 there is a more rational relation between the presumptive working life and the presumptive period of retirement.

It would even be sensible to choose between two further alternatives:

(a) That from 65 to 69 the criterion for benefits would be unemployment; while under 65 it would be invalidity, or inability to work;

(b) That under 70 benefits would be payable only for invalidity, or presumptive inability to work.

I should much prefer old-age benefits tied in with the age of 70, because this seems to me a more constructive approach

to the potential age at which most people have outgrown their working usefulness.

2. *Invalidity or Long-Duration Disability*

With such a presumptive minimum age for old-age retirement as 65 or 70, we need a reinforcing benefit status for persons who find themselves out of work over rather extended periods of disability below these advanced ages. In the German social security program, with its benefits under age 65 because of invalidity, we found, in the period between the wars, a majority of the workingmen at ages 63 and 64 already out of work. As has been earlier mentioned in this report, many of the German benefits were relatively high. It is also to be noted that employment conditions were unsatisfactory. It seems probable that the German experience represents an abuse rather than a valid use of the system.

Considerable damage has been done to many individuals through the choice of the phrase "permanent total disability" with its insistence that men and women to get benefits must not only show an almost complete inability to work today, but that presumption must be against any future possibility to return to work. This view is at variance with our experience with the natural curative process of the human body. The operation of this system may well have been most anti-social in discouraging the return of many such persons to a state of well-being and full employment. In a long-duration disability program today, it is desirable to recognize that there are many persons for whom temporary disability benefits become exhausted at the end of six months or one year, without adequate recovery having taken place; but that in many instances another six months or a year would be sufficient for convalescence and return to an active way of life.

By fixing benefits at the same low level of $25 a month per adult so that the disabled worker, the disabled housewife, or the attendant wife of the disabled worker were all regarded as beneficiaries, we might find at any time individuals still disabled after one year, or the wives of such persons, between the numbers of two and one-half million and four million individuals.

This would involve a budget of $750 million or $1,200 million; while, over time, with the growth in population, increasing capacity to deal with these situations might cut the beneficiary list, or increasing use of the system might increase it. Careful administration might hold the relationship of benefits to taxed pay roll down to 1 per cent to 2 per cent of such pay roll. It might increase it as much as 3 per cent or 4 per cent under unsatisfactory administrative methods.

This benefit is probably the least dependable, the least measurable in the social security area, and one dealing with an extremely important social need. It is brought into highlight by the national responsibility to the veterans, not merely for payments during the period of invalidity, but for sound measures of rehabilitation.

Experiences both with veterans and with civilians show that rehabilitation has a much better chance of success before disability has continued for a very long period. Those relatively recent victims of workmen's compensation accidents, whose skills have not gone too long unused, have responded more satisfactorily to training and such special efforts to adapt work to their handicaps than have the veterans of World War I after long periods in veterans' homes without opportunity for customary jobs.

Such a current budgeting approach in dealing with invalidity should have a preventive aspect—keeping men from becoming chronic recipients of such benefits.

3. *Orphan Children and Their Widowed Mothers*

Men may grow old and lose employment. They may become disabled and remain disabled for a long period of time. Men may also die. The current OASI program has provided that when an insured employee

dies, leaving orphan children under the age of 18, that such orphan children and their qualifying mothers are to receive benefit payments until the insured child reaches the age of 18, or after the age of 16 leaves school and goes to work. The 2.5 to 3 million paternal orphans under the age of 18 seem not apt to increase very much in number. The pronounced improvement in the death rates of young fathers is expected to improve still further. Most demographers and vital statisticians anticipate a shrinkage rather than a growth in family size.

Cost analysis as to the aged and the long-duration disabled persons has used $25 a month per person. We will use the same basis for each child and for the widowed mothers of these children who may number one million. It seems possible that since the younger children require less in the line of clothing and space accommodation in the home that $15 a month for children under six, $20 a month for children from 6 to 12 might be relatively in line with $25 a month for children over 12. The age distribution of the orphans shows a majority in the higher ages because mortality rates of young fathers of young children are much lower than the mortality rates of middle-aged fathers of older children; so the over-statement of cost with respect to the younger children will not be very pronounced. Three and one-half million children and mothers at $300 each, calls for an annual outlay approximating one billion dollars. Four million children and mothers would require about one and one-quarter billion dollars.

This is very crudely 1 per cent of the national wage and salary bill of 100 billions.

Advancing living costs will probably be balanced in the future by advancing earnings. It is the goal of many educators to extend the period of training of the child. If for example, education ran to age 20, instead of to age 18, the addition of the orphans would be at those ages where there are the most. Even though benefits advanced to $2 billion, the ratio to an expanded wage and salary bill would still seem to leave benefits not over 1½ per cent of pay roll.

The social justification for the reduction of a relief attitude in dealing with old-age benefits is even more important in dealing with children's benefits. So far as it is humanly possible to do so, it is desirable to have the children feel that they are receiving their benefits as a pooled provision, as in the case of benefits developed through the use of life insurance.

Summarizing the three programs, we may be dealing with an impact of cost today of from 4 per cent to 6 per cent, with a budget by the end of the century of from 7 per cent to 10 per cent. This is a much sounder balance than to establish benefit programs today of such small over-all magnitude that we anticipate the benefits for the next generation to be twenty to thirty times as large. Today under the combination of assistance and insurance programs, the major group of beneficiaries receives their grants as relief or charity. We have created a competition in the amounts of such benefits so that there is a demand for liberalization in both relief and insurance, and the aggregate cost is already much larger than the cost of the insurance benefits alone.

Budgeting for social security requires intelligent review before presentation of the program to a Congressional Special Committee or Congress itself. It requires the sort of balanced study which preceded the Beveridge Report in Great Britain, with an opportunity for all important elements of the population to be heard. It would seem desirable to aim at a changed benefit structure with perhaps two years of opportunity to get our national records and our national economy into shape. Age is an extremely important factor for both the benefits to the aged and the benefits to the orphan children. All prospective beneficiaries should have a chance to secure the best possible evidence of date of birth.

Budgeting for social security is a crude

over-all arrangement for a floor of protection only. It is designed neither to furnish a comfortable living, nor to meet every situation, even for a minimum required by individual need. Instead it will be buttressed by group methods of planned cooperation, such as group insurance and retirement plans, and by all the individual forms of thrift. It will also be reinforced for cases of particularly high living costs, or particularly serious needs by assistance, relief, and organized charity. It should, however, make unnecessary any relief supplementation for the large majority of beneficiaries and should serve to stimulate the group and individual programs which have been so prominent in the civilized development of America.

The basic viewpoint of this "Budgeting for Social Security" was set down by Miles M. Dawson in 1908 in a paper presented at Rome before the International Congress on Social Insurance, entitled "The Actuarial Basis of Compulsory Insurance." It is also in general evidence in social insurance reports in England, New Zealand, and Canada.

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ABSTRACT

Past programs of social security in America carried a bitter stigma. The recipient had to prove need. Today, emphasis is upon elimination of needs tests with benefits to be given as a right. When we find persons actually in need and administer to their needs, we add the stigma of charity by breaking down the sense of personal pride and personal responsibility. The way to avoid this dilemma is to provide for benefits for all based upon presumptive rather than actual need. Social budgeting counts upon the cooperation of all citizens to assume freely the burden for all citizens. It provides an over-all floor of protection through budgeting to care for three catastrophic situations: jobless old age, long-duration disability, and orphaned childhood and widowed motherhood. It is designed neither to furnish a comfortable living, nor to meet every situation, even for a minimum required by individual need. Instead, it should be buttressed by group insurance, by retirement plans, and by individual forms of thrift. It should make unnecessary any relief supplementation for the large majority of beneficiaries and should serve to stimulate the group and individual programs which have been so prominent in the development of America.

RÉSUMÉ

Les anciens programmes de sécurité sociale en Amérique portaient avec eux une amère marque d'infâmie. Celui qui recevait un secours devait donner une preuve qu'il était dans le besoin. Aujourd'hui l'emphase est mise sur l'élimination de la preuve du besoin, avec des bénéfices qui doivent être donnés comme un droit. Quand nous découvrons une personne actuellement dans le besoin et que nous lui venons en aide dans ce besoin, nous ajoutons la note d'infâmie de la charité en ruinant la fiertè personnelle et la responsabilité personnelle. Le moyen d'éviter ce dilemme est de pouvoir des bénéfices pour tous, basés sur un besoin présomptif plutôt qu'actuel. Le budget social compte sur la co-opération de tous les citoyens pour prendre librement la responsabilité du fardeau de tous les citoyens. Il procure la protection pour tous grâce à une répartition des recettes et dépenses qui prend soin de trois situations catastrophiques: le chômage de la vieillesse, une incapacité de longue durée,

l'enfance orpheline et le veuvage des mères. Il n'a l'intention ni de fournir un confortable moyen d'existence, ni de résoudre toutes les situations, même pour un minimum requis par le besoin individuel; au lieu de cela, ce budget devrait être soutenu par l'assurance mutuelle, des projets de retraite, et par l'économie individuelle de chacun. Il devrait rendre absolument inutile tout supplément de secours pour la plus large majorité des bénéficiaires et devrait servir à stimuler les programmes de groupes et d'individus qui tiennent une si grande place dans le développement de l'Amérique.

SUMARIO

Los viejos programas de seguridad social de los Estados Unidos llevaban consigo un doloroso estigma: los beneficiados debían probar su indigencia o necesidad. Hoy se trata de eliminar la necesidad de tales pruebas y de conceder los beneficios como algo a que los beneficiados tienen perfecto derecho. Cuando encontramos a personas necesitadas actualmente y proveemos a sus necesidades, nosotros agregamos el estigma de la caridad hiriendo la delicadeza y amor propio de tales personas, así como el sentido de la propia responsabilidad personal. El modo de evitar este dilema es proveer beneficios para todos, basados más bien en las presumibles necesidades de las personas y no en sus necesidades actuales. El presupuesto social debe contar con la cooperación de todos los ciudadanos para asumir voluntariamente la carga por todos los ciudadanos. Por medio de este sistema de presupuesto social se cubre un amplio campo de protección, y se atiende a tres situaciones catastróficas: el desempleo en la vejez, incapacidad prolongada, y la orfandad y viudez desamparadas. Nada se ha proyectado ni para proveer un modo confortable de vida, ni para enfrentarse a cada situación, ni aun para proveer al mínimum requerido por la necesidad de cada individuo. Esto debería ser apoyado por el seguro del grupo, por planes de retiro o jubilación y por formas individuales de economía. Con esto se haría innecesaria cualquier ayuda suplementaria para la gran mayoría de los beneficiarios y serviría para estimular los programas individuales y del grupo que tanto predominio han tenido en el desarrollo de los Estados Unidos.

СВОДКА

Прежние программы общественного обеспечения Америки носили на себе темное клеймо. Получатель должен был доказать, что он нуждается. В настоящее время устранены допросы о нужде, и помощь оказывается как нечто должное. Когда мы находим действительно нуждающихся людей и оказываем им помощь в виде благотворительности, мы этим задеваем их чувство гордости и умаляем чувство личной ответственности. Чтобы обойти эту дилемму, следует оказывать помощь всем, основываясь на предполагаемой, а не на фактической нужде. Общественная финансовая смета расчитывает на сотрудничество всех граждан и на принятие ими на себя ответственности за всех граждан. При составлении сметы общественное обеспечение принимает во внимание три катастрофических обстоятельства: безработную старость, продолжительную нетрудоспособность, сиротство в детстве и вдовье материнство. Это общественное обеспечение не предусматривает никакого комфорта и в него не входит целый ряд случаев, иногда требующих только необходимый индивидууму минимум. Это обеспечение должно быть дополнено групповой страховкой, пенсионными взносами и личной бережливостью. Все это устранило бы необходимость оказания дополнительной помощи большинству этих категорий; дало бы стимуляцию групповым и индивидуальным планам, которые сыграли такую важную роль в развитии Америки.

Youth consists of the formative years; old age, of the informative years.

ESAR

Old age brings experience, and some kinds of experience bring old age.

ESAR

Attitudes Toward Aging and the Aged: Primitive Societies

DR. LEO W. SIMMONS

IN CONTRAST TO MODERN CIVILIZATION, OLD AGE IS SOMETHING OF A RARITY IN PRIMITIVE SOCIETIES; MOST PEOPLE DIE IN YOUTH OR IN MIDDLE AGE. BECAUSE OF THEIR RARITY, THOSE FEW WHO DO SURVIVE THE RIGORS OF PRIMITIVE LIFE ARE USUALLY AWARDED CONSIDERABLE DISTINCTION AND PRESTIGE. PRIMITIVE CULTURE SUCCEEDS TO A GREAT EXTENT IN UTILIZING THE SERVICES OF THESE FEW OLD PEOPLE AND SO GIVES THEM AN OPPORTUNITY TO BE REGARDED AS TREASURED ASSETS. WITH FAR LESS MEDICAL KNOWLEDGE, THEY ENTERTAIN MANY EFFORTS TO FIND SECRET REMEDIES FOR REJUVENATION. WHILE MODERN CIVILIZATION HAS ADDED MORE YEARS TO LIFE, IT TENDS TO LEAVE LESS LIFE IN THE YEARS.

OLD PEOPLE have always been a problem in every human society, but the nature of the problem and the methods of solving it have changed considerably in different societies and at different times. In spite of everything that has been learned about old age in human history and experience, the problem has become increasingly acute as civilization has advanced. Indeed, in spite of all the marvelous achievements of our modern times, it can be questioned whether the place of the old in society has not been more satisfactory in many respects under simpler and more primitive conditions. The charge can certainly be made that civilization has *created* as well as solved problems of old age. To say the least, there is still much uncertainty and confusion concerning the proper and expedient place of old people in our society. Perhaps we are more confused and perplexed over the matter than have been our more primitive predecessors and contemporaries. Thus there is need to learn more about the attitudes toward aging and the solutions worked out by them. We may find therein some clues to the basic nature of the problem of aging.

When we select a generous sampling of primitive peoples throughout the whole world—under different physical conditions and within different cultural milieus—and examine their attitudes toward aging and their adjustments to old age, we are bound to be impressed at first with the great variety of problems that can stem from senescence and the many contrasting solutions that have been tried out and seem to work reasonably well in their cultural context. Later on, however, when we gain wider familiarity with the subject, we find that certain underlying uniformities appear in the many problems that arise and in the different adaptations that are made to them. It is these uniformities that interest us most, and some of them will be noted at the beginning.

Expressed in its simplest terms, and ignoring exceptional variations, the social problem of old age in human society factors down to two questions: What does it mean to anyone to grow old? And what can be done about it either by the aging person himself or by the society in which he lives? Or, asked in another way: What are the chief interests of old people? And how may these interests be properly safeguarded without too great infringement upon the rights of younger people? Or, perhaps the aged themselves would prefer to inquire: In what positions and under what circumstances can old people get the most out of life and at the same time contribute most to society? Needless to say, there is no short and satisfactory answer to any one of these questions. Even if some primitive peoples, without the benefit of civilization, have had

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more direct and positive answers than we now have, that does not imply that their solutions would fit our times. A good answer for one society can be very bad or even impossible for another. There is, however, encouragement to be found in the suggestion that problems of human existence which have found more or less satisfactory solutions under more primitive conditions of life may not prove insoluble, even though they may be more acute, with the immense complexities of modern civilization.

What, then, are some of the common underlying factors in the problem? In general, among primitive peoples, greater uniformity can be found in the interests which old people cherish than in the adjustments which are made to old age. It appears that, when minor differences are allowed for, the basic interests of the aged can be summed up roughly as fivefold:

1. To live as long as possible, at least until life's satisfactions no longer compensate for its privations, or until the advantage of death seems to outweigh the burdens of life.
2. To get more rest, release from the necessity of wearisome exertion at humdrum tasks and protection from too great exposure to physical hazards—opportunities, in other words, to safeguard and preserve the waning energies of physical existence.
3. To remain active participants in personal and group affairs in either operational or supervisory roles—any participation, in fact, being preferable to complete idleness and indifference.
4. To safeguard or even strengthen any prerogatives acquired in a long life, *i.e.*, skills, possessions, rights, authority, prestige, etc.
5. Finally to withdraw from life, when necessity requires it, as honorably as possible, without too much suffering, and with maximal prospects for an attractive hereafter.

These, with minor variations, seem to be about what old people want in primitive societies—and perhaps elsewhere—and they may be summed up in the word security, if it is used with broad connotations.

There is, also, some uniformity in the adjustments that are made to old age. Everywhere the human cycle begins with the dependency of the young on those who are older, and usually ends with the dependency of the very old on those who are younger. The extent of dependency at either end varies with different societies, but where the chief difference lies is with respect to the aged. In this respect man is set apart from all other animals. For while animals, too, have a period of dependency of the young, provided for by the instinct to protect them on the part of those who are older, among lower animals, there is no period of dependency of the aged, and no instinct which impels others of their group to protect them. As soon as lower animals get to the point where they no longer can take care of themselves adequately, they perish.

Thus the problem of aging among human beings is basically a social and cultural one, involving conscious attitudes and feelings of responsibility or obligations on the part of members of the group, or the group as a

whole, towards those who have become dependent through age. Accompanying this, there are also conscious efforts on the part of the aged to maintain their positions in the group and to insure support.

The chief means by which old people retain, or strengthen, their positions and their security is by expedient adjustments to other people, or to society at large. In the prime of life and physical prowess, human beings may gain great advantage through exploitation of the material environment about them, but as the frailties of age accumulate, their main security must rest more and more upon their relation to others and to the social systems within which they live. In other words, anyone's security in old age must rest primarily upon his social prerogatives, upon such duties, rights, and privileges as may be established in the mores of his own society, through which he has recognized claims. Thus, a satisfactory old age for anyone, perhaps anywhere, depends chiefly upon the amount of persuasion that may be exerted upon the young and strong to serve and to pay homage to the needs and interests of the old and feeble. In primitive societies, aged individuals have received or achieved the greatest fulfillment of their interests through personal adjustments to such major institutions as the domestic organization, the economic system, government, magic and religion, and what may be called the learned or skilled professions. Basically, then, we may anticipate that security and survival in senescence are not a boon of nature, nor a gift of the gods; they depend upon the contributions which old people can make or the rights which they can command in the particular groups of which they are members.

Domestic Relations

Throughout human history the family has been the safest haven for the aged. Its ties are the most intimate and long-lasting, and on them the old rely with greatest success. When other supports crumble and disappear, old people cling to kith and kin even more closely; and the astute among them not infrequently manipulate such bonds to great personal advantage. Indeed, many persons are able to find in family relationships opportunities for effective participation well on into senility, and even to exploit some rights which outlast life itself, for the last wishes of aged parents are not lightly ignored by their offspring.

One obvious way in which some old people gain advantage through family relationships in primitive societies is to marry younger mates. This is a rather widespread practice, especially on the part of men. And where old women are unable to marry younger men, they sometimes encourage their aged husbands to take other young wives in order to lighten their own labors and perhaps to enhance their positions in the family circle.

Examples of the marriage of youth and age in primitive societies are plentiful. The ethnographer's interpretation of the Omaha custom is quite matter-of-fact: "Looking at the duties and the customs of the tribe, it seems that the question of domestic labor had a great deal to do with the practice of polygamy. 'I must take another wife. My old wife is not strong enough now to do all the work alone,' was a remark made not as offering an excuse for taking another wife, but as stating a condition that must be met, and remedied in the only way that custom permitted." The custom is common not only among American tribes, both north and south, but also in Africa, where often a man's wealth is measured by the number of his wives and their vigor and youthfulness. There a native remarks: "To own one wife is as big a risk as to own only one belt for palm climbing. If it breaks, you are done for."

In a Chukchi family in Siberia: "The first wife sits with the husband in the warm sleeping room, while the second works outside in the cold . . . prepares the food, and serves it. Sometimes an aged husband takes a second young wife for the express purpose of giving a helper and maid to his wife, who is getting old and cannot get

through with the housework by herself." Instances occur where the first wife insists that the husband marry a younger and more able-bodied woman.

The marital domination of old men in Australia is widely reported. One authority states that because of the success of the older men in monopolizing the younger women it becomes difficult for young men to obtain wives at all. The situation among the Banks Islanders has also been summed up thus: "We seem therefore driven to assume a state of society in which these elders have acquired so predominant a position in the community that they are able to monopolize all the young women."

When such reports from many widely dispersed tribes are brought together and analyzed, it would appear that old men have much greater opportunities to marry young mates than have aged women, but the success or failure of either seems to be strongly conditioned by cultural factors. Old men tend to find their best opportunities in patriarchal societies and perhaps among herders. The evidence indicates that in the presence of general cultural advance, the practice persists longer in favor of men than of women, but tends to decline for both.[1]

More important for security in old age than marriage to youthful spouses is the possession of rank and authority within the family circle, particularly the aged person's own family of procreation. Indeed, whether marriage to younger mates proves more of an asset than a liability depends in part upon the prerogatives vouchsafed in the marriage bond and upon other rights and privileges within the family unit. The authority of parents over their children, for example, prevails in the most rudimentary as well as the most complex societies. Other vested interests often affect a wide circle of relatives—in-laws, siblings, nephews, nieces, grandchildren, and others who come within the orbit of the kinship system. Such family prerogatives for the aged vary greatly and no classification of particular rights and privileges can be offered here. Most of the data drawn from societies with matrilineal descent indicate that in such tribes aged men and women both are usually able to realize considerable authority and prestige through family and kinship ties; and that the women appear to enjoy about as high a position as the men; perhaps even higher. In patrilineal societies we find that aged men are able to realize a great deal of power, much more indeed than in matrilineal groups; but it can be questioned whether old women enjoy equal rights. Many striking cases can be cited of the extreme authority of aged fathers over their descendants and over their wives. Nevertheless, some instances can be found where very aged parents are pitifully abused by their children and other relatives.

When a controlled analysis is made, it appears that old men are at greater disadvantage in matrilineal societies, and in groups with the simpler forms of economic development. On the other hand, among herders and farmers, where residence is fairly permanent, where the food supply is more stable, and particularly where the patriarchal family system prevails, the old men are at a distinct advantage in the exercise of control over their families. Statistical studies further indicate that the development of more complex economic systems, a shift from matrilineal to patrilineal descent, and elaboration of government, laws, property rights, and religion are all accompanied by a trend toward increasing domination by old men in family affairs and a corresponding enhancement of their prerogatives.

The evidence is different in the case of old women. Their position and domestic prerogatives generally rate lower in patriarchal societies, where polygamy occurs, where property rights in women are pronounced, and where general subjection and inferiority of women prevail. In simpler societies and where the mother-family exists,

[1] For detailed documentation and statistical analysis see author's book, *The Role of the Aged in Primitive Society*, Yale University Press, 1945.

old women wield considerable influence; but among herders and perhaps cultivators of the soil, and under the patriarchal system they lose dominance. Therefore, their prerogatives in the family tend to be more irregular and less secure than those of old men.

Family responsibility for the care and support of the old is not necessarily correlated with the domestic dominance of either sex, and should therefore be treated separately. Here the relative status of the sexes in old age seems to be less significant. The family organization and the stage of economic development also exercise a less direct influence. But in general, in the matter of family care and support, both old men and old women tend to receive better care in agricultural societies, where residence is permanent, and where the food supply can be kept more or less constant. Such care and support seem also to improve for both sexes wherever there exists strongly centralized political authority, codified laws, hereditary castes and classes, and other traits of more advanced primitive cultures. The evidence seems to show that in primitive societies aged men and women everywhere rely more or less on the family for ultimate care and that such reliance is very nearly universal, irrespective of the form of the family organization, economic development, or any other cultural variations.

Another family relationship of significance for the aged is the intimate association of the very young with the very old. Frequently they are left together in camp or household while the able-bodied of both sexes go forth to earn the family living. These oldsters, in their wisdom and experience, protect and instruct the little ones; while the children, in turn, act as "eyes, ears, hands, and feet" for their enfeebled old friends. Care of the young thus very generally provides the aged with a useful occupation and an active interest during the long dull days of senescence.

In a social sense, one could say that the aged often return to childhood, when, with the little ones, they "keep house" for the breadwinners. Among primitives, this practice is very common; and such a youth-age partnership is advantageous to both children and the aged. Here again we find that for old people social participation, rather than withdrawal, is most rewarding. The old men and women who cultivate the children have something more to live for, and at the same time they serve the group and achieve security for themselves.

It seems apparent thus, that the reliance of old people on younger members of kith and kin is a human adjustment so nearly universal in primitive societies that it cuts across most cultural traits and trends and any combination of them. Of course, as old people suffer an increasing loss of both physical and mental powers, with no hope of ever regaining them, they differ significantly from the young, the sick, and the temporarily disabled. They are thus forced to withdraw permanently from the rigors of life and to retreat within the bosom of the family. There they take their last stand, relying more and more upon their kinsmen. But such a retreat to domestic shelter does not imply a mere passive and parasitic existence. They still have their skills, knowledge, and experience, their magical and religious qualifications, and their property rights and other prerogatives which they may continue to use to the best of their ability; and it would seem that few expedients have been left untried by old people in their attempts to enhance their security within the confines of the family.

The Economic System: Activities and Rights of the Aged

To live is the first and the last care of life. Thus food in proper amounts, on regular schedule, and in suitable form, is a matter of increasing importance to the aged as they become more dependent. Such dependence may reach a stage that requires no less than the choicest morsels and the gentlest care. Among animals in their native habitat the old never survive to such a degree of dependence; and with man in

his most primitive state it is probably rare.

But in the most rudimentary human societies of which we have reports, there are at least some customs of food sharing with the aged and some rights to subsistence that are generally observed. In fact, in many such groups, where conditions of life are hard and uncertain, there are general rules of food sharing by all, in which the aged participate. A number of these tribes have special food-sharing privileges which particularly favor the old, sometimes in a more or less organized manner; and there are many groups which impose specific food taboos upon all young people but allow free access to the same foods to the old. Indeed, indiscriminate eating is rather commonly believed to be dangerous. Thus long lists of tender morsels are strictly forbidden to children, to young and middle-aged men, or to child-bearing women; but they are regarded as safe for old people because of an immunity built up through a long life. Though it is difficult to demonstrate that oldsters have ever invented such social expedients in their own interest, many of the tabooed foods are recognized by all as very desirous, while the old people stress the taboos and eat the relished foods.

Such taboos of a tribe in Australia (the Arunta) will illustrate the practice. "The idea throughout," says the ethnographer, "is evidently that which obtained so largely in savage tribes; of reserving the best things for the use of the elders, and more especially the elder men." A list of forbidden foods among these people includes the following, with the consequent penalties:

Wild turkey and its eggs: premature age.
Female bandicoot: probable bleeding to death at pregnancy.
Emu fat: abnormal development of the penis.
Parrot and cockatoos: development of a hollow on the top of the head and a hole in the chin.
Quail and its eggs: general stoppage of growth and no beard.
Eagle-hawk, except the legs: premature age and leanness.
Wild-cat: painful and foul smelling eruptions on head and neck, which applies until very old age is reached.
Pogargus and its eggs: an ugly enlargement of the mouth.

The following additional food restrictions apply to girls and young women until they have had a child or until their breasts become pendant.

Female bandicoot: continued flow of menses.
Large lizards: abnormal craving for the opposite sex.
Large quail and its eggs: no development of the breasts.
Brown hawk: absence of milk from the breasts but a swelling that will cause them to burst.
Kangaroo's tail: premature age and baldness.

A general impression from the review of many tribes is that assurance of some food from a group or communal source can be found in the simplest known societies. Moreover, it appears that the custom of communal-food sharing with the old is often strongest in very harsh and difficult environments, where the food supply is not constant, and where the economy is simple, as among collectors, fishers, and hunters. With advance to herding and agriculture, and the development of cultural traits characteristic of "higher" societies—such as grain supplies, property, trade, debt relations and slavery—support of the aged through communal sharing of food appears to decline in importance or to take on features resembling "organized charity." In the analysis of food-taboo privileges favorable to the aged, trends cannot be clearly traced, but it would appear that in the evolution of society towards greater complexity these privileges arise as adaptations at certain limited phases of social development, and that they eventually give way to other and more adequate forms of security in old age.

A more enduring form of economic opportunity for old people is property rights. Wherever such prerogatives are firmly entrenched in a culture they supplement, and often supplant, communal forms of food sharing and support. They enable the individual to store up reserves, or credits, against the hard days ahead. Property rights prove flexible, impersonal, and effec-

tive in securing the services of one's associates, irrespective of kinship ties or other social bonds. Moreover, the enforcement of property rights depends very little upon the physical stamina of their possessors, but mainly upon the mores and the authorized agents of society who compel observance by means of sanctions. Probably always there has been a marked difference between growing old with property and without it, for the requests and commands of the aged possessing such claims have carried more force than the "petitions of the decrepit and poor." Even in feeble hands and in primitive societies, vested interests have proven very effective means of getting wants satisfied. Indeed, the importance of property for old-age security can hardly be over-rated.

Perhaps the simplest and most common form of property rights shared by the aged is the exchange of gifts and the receipt of fees in return for services rendered or in fulfillment of obligations. Such transactions, in one form or another, are found practically everywhere, and they tend to increase in importance with the development of property rights.

Certain social and cultural factors seem to affect the holding of property rights by aged men and women and two important generalizations can be drawn from the available material. First, sex differences are striking: aged men and women do not share alike in opportunities to acquire control of property, and apparently the same social factors do not operate uniformly for both. Second, the opportunities to acquire and exercise property rights by either sex in old age are quite variable, and are strongly conditioned by environmental and cultural factors beyond personal control. Aged women tend to acquire property rights more readily than men in simple societies characterized by collecting, hunting, and fishing, and also within the matrilineal form of family organization; while old men gain greatest advantage among farmers, and especially herders, as well as within the patriarchal system of family life and in more advanced cultures.

This is not to imply that aged women do not sometimes fare better with respect to property rights in herding or agricultural societies than among hunters and fishers. Indeed, when farming and herding groups are characterized by the mother-family system, aged women generally have some advantage over men; but in more complex societies, especially where a strongly patriarchal family system prevails, old men generally surpass women in such opportunities.

To "get capital," then, has been important for old-age security almost everywhere, all the time, and for everyone. In simpler societies aged women seem to have had a more nearly equal chance with men, but with the development of culture men have found it is possible to get and to control more property, and women have come to rely more upon other forms of old-age security.

We have emphasized that in primitive societies certain forms of economic security for old people—such as food sharing and property rights—arise as by-products of impersonal environmental and social forces which vary from culture to culture. The factors of personal initiative and individual adjustment have thus far been touched upon only incidentally. But the activities and the initiative of old people themselves greatly influence their place in society. The more successful old people have seldom been the passive ones, and their security has been as much an achievement as an endowment—an achievement in which favorable opportunities have been matched with active personal accomplishments. Evidence of this is found in the fact that individual achievements in security vary immensely under similar social and cultural conditions and even within the same society. The adaptive activities of the aged in economic life, therefore, are important for an adequate understanding of their status in any society.

In the more primitive groups all able-bodied persons generally participate in the tasks of subsistence. They collect and prepare the food, fish, hunt, or herd. They

cultivate plants, manufacture weapons, make and operate tools or rudimentary machines, and practice the useful arts and skills. But as old age and other physical ailments overtake them, they generally step aside by degrees, relinquishing to others the major tasks of maintenance and production. Their tasks then become supervisory or auxiliary, and the paths to their goals no longer so direct, but through the interests and activities of others. Their security then comes to depend less and less upon manipulation of things and more and more upon adjustment to and manipulation of people. Their further accomplishments usually involve service to others as well as enticement of others into their service. This makes it necessary for them to cooperate more actively with others and to supervise or assist them in order to insure support and deference in return.

Perhaps the simplest and most direct means of eliciting the support of others is to render essential—and, if possible, indispensable—services to them; a common adjustment of the weak who would gain the support of the strong. It has been no secret that aged or otherwise weak and handicapped persons who lend a helping hand or a useful idea after they have become too feeble to forage for themselves generally stand a better chance of sharing in the gains of the strong. The case is neatly presented in a report by James Moffat, quoting an old Hottentot woman whom he found abandoned in a desert place: "Yes, my own children, three sons and two daughters, are gone to yonder blue mountain and have left me here to die. . . . I am very old, you see, and am not able to serve them. When they kill game, I am too feeble to help with carrying home the flesh. I am not able to gather wood and make a fire, and I cannot carry their children on my back as I used to do."

Opportunities for further security through auxiliary services to others, although available everywhere to some degree, vary from place to place, and are conditioned by such factors as climate, permanence of residence, constancy of food supply, and especially by the economic activities of a particular group. A general survey of tribes has seemed to indicate that such opportunities are less prevalent in the simpler societies characterized by collecting, hunting, and perhaps fishing. More opportunities are usually found among herders and cultivators of the soil. An illustrative case may be taken from the Hopi in northeastern Arizona, a herding and farming people.

Old men among the Hopi tend their flocks until feeble and nearly blind. When they can no longer follow the herd, they work on in their fields and orchards, frequently lying down on the ground to rest. They also make shorter and shorter trips to gather herbs, roots, and fuel. When unable to go to the fields any longer they sit in the house or kiva where they card and spin, knit, weave blankets, carve wood, or make sandals. Some continue to spin when they are blind or unable to walk, and it is a common saying that "An old man can spin to the end of his life." Corn-shelling is women's work but men will do it, especially in their dotage. Old women will cultivate their garden patches until very feeble and "carry wood and water as long as they are able to move their legs." They prepare milling stones, weave baskets and plaques out of rabbit weed, make pots and bowls from clay, grind corn, darn old clothes, care for children, and guard the house; and when there is nothing else to do, they will sit out in the sun and watch the drying fruit. The old frequently express the desire to "keep on working" until they die. One observer notes: "Retirement is impossible at any age. One cannot in Hopi society pile up credit which will support one, nor can one save material on which to live long. Some of the 'rich' may have enough corn to last for four or five years, but that is always to be treated as a reserve store, never as something which in the future will provide leisure. The aged who have sons and daughters who could provide for them continue to work as long as they are able to do anything whatsoever."

In general, opportunities to work at essential but light tasks are obvious assets to old-age security; but such labors which continue far into senescence may insure little more than mere subsistence, and are often quite barren of any other personal satisfaction. Indeed, complete retirement from daily duties may prove far more rewarding than repeated demotion down the levels of drudgery. Moreover, a compromise

job, while lighter than normal labor, often involves a threat to prestige, as in the case of a dignified old warrior confined to "woman's work." Thus subsistence work alone can become no more than a toehold on security.

There are certain jobs, however, in which old people can participate to much greater advantage. One is to direct the activities of others through control of property rights, as described above. Others include the direction and supervision of people through political power or family prerogatives. In addition to these, the aged often retain job rights or directive roles through the accumulation of experience and familiarity with special skills. In most primitive societies, in fact, the aged commonly possess certain expert skills which enable them to become leaders, if not monopolists, in certain specialized functions. Not infrequently are they skilled in the arts and crafts, such as pottery, basketry, housebuilding, boat construction, metal work, and the manufacture of clothing, tools, weapons, and other implements. Furthermore, they are often in great demand as initiators of complicated techniques and procedures; and they quite generally fill the roles of magician, healer, shaman and priest—activities to be described later on.

A rather surprising specialization for old people is that of "beauty expert." In many instances they are in charge of operations made on the human body to enhance its personal charm, to signify adult status, or to protect against evil spirits.

Midwifery is a specialty associated almost universally with old women. Although aged men generally treat sick women and prescribe remedies for pregnant ones, even "turning the child to come out," they rarely assist in actual childbirth, except perhaps in difficult cases. They function more often in the naming of children and in the performance of rituals believed to safeguard their welfare. These expert skills and practices associated with childbirth and infancy have doubtless provided old people with points of advantage in security, for those who control major crises in the lives of others, matters of life and death, tend to profit, however unselfish their own motives may be.

The knowledge and experience of the aged also qualify them to be leaders in games, songs, dances, and various other forms of entertainment. The rules for games are stored in their memories, the songs often come first to their lips, and the dances are frequently led by them. Above all, they function as leaders of festivals and ceremonies where ritual is important.

Thus old people, who might well be conserving their strength, exert themselves strenously in leadership, games, and entertainment. This is often done at very great effort, perhaps to compensate for their declining strength. Their frequent use of humor may be another form of compensation. The point of significance with respect to their security, however, is that in many primitive societies these performances are highly rewarded—the old people becoming, so to speak, star performers.

Another popular and very common function of the aged is storytelling, a pastime that serves the three-fold purpose of entertainment, instruction, and moral admonition. Anyone who enjoys modern facilities for entertainment can hardly appreciate the enviable position held by the old men and women of primitive societies who have an ample supply of interesting legends and tales. They are almost invariably in great demand and profit thereby.

In summary, it may be concluded that an important means of security for old people, when they become too feeble to forage for themselves, is active association with others and assistance in their interests and enterprises. The aged may engage in secondary economic functions and make themselves useful in field, camp, shop, and household. They may concentrate on the lighter tasks, or utilize their long experience and greater knowledge in complicated skills, rituals, and ceremonies of daily life. Although such opportunities may differ for men and women, and under different environmental

and cultural conditions, they are basic adjustments in security for both sexes in old age.

Government and Authority of the Aged

The principle has been stressed that old people must depend largely upon others for security and that the deference which they receive from younger people is crucial to their success in senescence. A partial survey of the activities of the aged shows that some security is obtainable through the performance of lighter tasks useful to others, but that such labors are rarely as rewarding as the exercise of wisdom, skill, and tact in social relations. Thus the security of old people depends much more upon their wits than upon their work; and fruitful fields for such talents are found in political, civil, and judicial affairs.

The office of chieftainship and membership in official councils, regulative organizations, clubs, and secret societies afford old people positions of usefulness and prestige in which well-established prerogatives, ripe experience, and special knowledge can often more than compensate for physical handicaps and waning vitality. Not infrequently age itself is regarded as the main qualification for such offices, but more often those who show exceptional ability or who achieve positions of importance and power through long and active lives manage to hold on to them into late old age. The extent to which aged individuals obtain and hold such positions depends, of course, upon both personal initiative and impersonal cultural factors.

It can be demonstrated that generally people who settle down to more or less permanent habitation develop more centralized and authoritative forms of political organizations, with greater administrative powers vested in chief executives. While chieftainship is found to be almost universal, the authority exercised by the chief tends to be weaker among collectors and hunters, somewhat stronger among fishers and herders, and most effective among cultivators of the soil. As might be expected, the basic institutions and agencies of political regulation and social control appear in rudimentary form in simple cultures and develop with advancing economic systems, generally reaching their greatest strength among herders and tillers. From this it seems proper to conclude that among herders and farmers old men, at least, have been able to derive greatest advantage through adjustments of a civil and political character.

The chieftainship is not infrequently occupied by aged persons. Indeed, old men have functioned as chiefs in the simplest as well as in the most complex social organizations. Although in late life some of their authority and duties may be delegated to others, they are rarely ever deposed. They often continue to exercise authority in very late age and not infrequently have the right to name their successors.

If tenure of office involved chiefs and headmen only, the subject would not be very significant in a study of old age. But usually there are associated with rulers certain aging councilmen and advisors who exercise considerable influence in government and over the office of chieftainship. The fact that the use of the term "elder" has so commonly implied leader, headman, or councilman, suggests the important role of the aged in government. Indeed, there are societies in which age alone qualifies men for membership in government councils, but active participation usually depends upon other qualifications than mere age. The office of councilman or advisor to a more energetic and active administrator is an especially suitable role for individuals of broad practical experience and wisdom who have become physically incapacitated by age, but who are still mentally alert and keenly concerned with public affairs. It provides opportunities for active participation which are sufficiently rewarding to attract the interest of aged persons in nearly all societies.

Closely associated with eldership and council influence are arbitration of disputes

and administration of justice. Indeed, very often the office of ruler and judge cannot be distinguished; but in many instances the political councils of elders are also the tribunals of judges for civil and criminal cases. The role of the aged in the maintenance of order and the settling of disputes —as guardians of the *status quo*— is so prevalent, indeed, that unlimited cases could be cited.

The aged, especially men, are also frequently associated with secret societies, and are thereby able to increase their authority through the instrumentality of well-guarded secrets and elaborate, sometimes very severe, initiatory rites. The indications are clear that wherever such organizations exist they tend to come under the control of old men who can use them to advantage in the domination of youths and even adults. Indeed, initiatory devices are so effective as disciplinary measures that they are widely used, often even where organized societies do not exist, as in *rites de passage*, marking the attainment of puberty and adulthood. The manipulative facility of these rituals and the opportunities which they afford aged persons to control the conduct of others can hardly be appreciated without first-hand experience of the cases. There is no doubt that the aged of both sexes are frequently found occupying dominant roles in this sphere and thereby realizing for themselves a great deal of authority and prestige. Monopoly of the secrets and manipulation of the initiatory rites provide very convenient and effective instrumentalities for the instruction, discipline, and domination of youth.

In a summary way it may be said that political, judicial, and civil preferment provides a major field for effective social participation of aged people, particularly those who have already attained positions of prominence and responsibility in the prime of life. The title, and often the office, of chieftainship tends to be life-long. Councilmen and elders often fill their functions into very late old age. Old men, moreover, may serve long and well as law-makers, judges, and administrators of justice. Finally, as leaders in secret societies and initiatory rites, the aged quite generally receive deference, for they, more often than not, are the ones who control the *rites de passage* from immaturity and subordination to adulthood, status, and responsibility.

The attainment of such positions of influence and power in primitive societies is, however, largely dependent upon three factors: individual ability and initiative, sex, and a favorable combination of social and cultural conditions. In relatively rare instances does age alone qualify one for civil positions of responsibility, and in most instances a state of senescence is eventually reached when the incumbent of office ceases active participation, retaining little more than symbolic powers. Old men are overwhelmingly favored over old women in important political and civil offices in most societies, although aged women often perform prominent functions in initiatory rites. Finally, with advancing economy, greater complexity and integration of social organization, and general improvement in societal stability the aged tend to enjoy a steadily rising enhancement of status in civil and political affairs.

The Use of Knowledge, Magic, and Religion

Knowledge, wisdom, and experience are social assets which normally accumulate with age and outlast physical stamina. The possessors of these qualifications are always in demand for imparting general information, interpreting strange and mysterious phenomena, preaching ethical standards and ideals, diagnosing and treating diseases, and providing comfort and guidance to the distraught and bereaved. Seers, magicians, medicine men, and priests are frequently old people. They serve as mediators between man and the great unknown—the imaginary environment—peopled with unfriendly spirits and devils as well as benevolent beings and gods. When faced with common perplexities, distressing anxieties, and personal crises of

every kind, primitive peoples generally turn to their "old wise ones" for help and council; and the aging individual with enough experience, insight, and skill to suggest or do something, or even to make it appear that something can be done in the hour of human need, usually reaps a reward.

Among preliterate peoples memory is the only repository of knowledge, skills, and rituals. Where writing and records are unknown—where all that is worth knowing has to be carried in the head—a lucid mind, a good memory, and a seasoned judgment, even when housed in a feeble frame, are indispensable and treasured assets to the group. Those endowed with the art of writing and surrounded by printed documents can scarcely appreciate the inestimable social value of an aged person who possesses more knowledge than any other source within reach. There are unlimited examples of the role of the aged as custodians of folk wisdom. The Hebrew axiom that "with the ancient is wisdom; and in length of days understanding" is practically universal among primitive peoples.

Few conclusions concerning the aged in primitive societies can be made with greater confidence than that they are very generally regarded as the custodians of knowledge *par excellence* and as the chief instructors of the people. Examples can be found everywhere, and it is a common practice of ethnographers in their field investigations to search out these old people as the most reliable sources of information. The various ways by which the aged utilize this advantage will bear close study

The old seem to be peculiarly qualified for the practice of shamanism. They are the ones with longest experience and most knowledge; sometimes, even, it is believed that parts of their bodies have acquired supernatural power. Not infrequently they themselves claim to be in communication with the dead and other spirits, and even with the gods. They have strange and mysterious remedies for breaking taboos, treating disease, foretelling the future, and driving out the spirits. Sometimes they boast—more often they are accused—of possessing powers of sorcery and witchcraft; and, being so near the end of their lives, they will soon become spirits themselves, perhaps powerful ones, who will be able to punish those who have neglected or offended them.

Moreover, to primitive people the problems most frequently treated by magic do not appear solvable by purely physical means, but call for the more subtle methods which are in possession of the old and wise. It is not, for example, strength of brawn alone that can stave off bad luck, win the maiden's heart, heal the dreaded disease, remove the poisoned arrow, bring the rain or sunshine, divine omens, "fix" the enemy, cast out evil spirits, or placate angry gods. It is a special power, strange, mysterious, and most potent—as well as safest—held in the hands of the old wise ones, and exercised in the light of their wisdom and experience. From the viewpoint of the aged themselves, such "supernatural" endowments become assets with which they may compensate for their own disabilities on the physical plane.

For the aged in certain social milieus, then, the "call to magic" is well nigh irresistible; especially since their services in this field are so urgently sought after. Thus the old person who can work "miracles," or even appear to do so, can find plenty of younger and stronger persons both able and willing to do his bidding in order to secure his aid in situations where esoteric knowledge is at a premium and physical efforts of no avail. Here the aged possess a further advantage, for, with their superior knowledge, should a charm or a bit of magic miscarry, they are in a position to explain away the mistake. Any wise old shaman can confidently affirm in the face of mishap that had it not been for this or that additional factor, for which he is not at all responsible, the "medicine" would have worked; or, better still, except for his timely intervention something much worse might have happened.

The luck element thus becomes for these

old people a useful ally. Indeed, it may be that in their interpretation of good and bad luck the aged can exert their greatest power in social relations. Especially where shamanism is an established practice may the aged exploit the realm of the unknown, where luck and chance hold sway. Not all magicians are old nor are all old persons shamans, but superannuation and the supernatural are very commonly linked.

Let us cite one example of the claims of occult power attributed to the aged. Certain old men among the Polar Eskimo are reputed to be able to raise storms, produce calms, call up or drive off birds and seals, steal men's souls out of their bodies, and cripple anyone for life. They can fly up to heaven or dive down to the bottom of the sea, remove their skins like dirty garments and put them on again. Old women can make "soul flights" to the realm of the dead and thus save the lives of very sick persons. All these mighty works are said to be wrought by magic words.

It is obvious from the abundance of available cases that the widespread belief in and practice of magic has an important influence upon the role of the aged in primitive societies. The vast majority of these peoples, when faced with crises, turn to their elders for help and guidance. And the old people do not hesitate to give counsel and aid. Those who claim to possess knowledge and special powers do something, or make it appear that they can do something, to temper bad luck and to cushion hard fate. At least they make an attempt, and then explain with confidence how matters would be worse but for their timely intervention. It can be no great surprise, then, that so many old people, with their vigor ebbing and their days numbered, should grasp eagerly such opportunities to render service to their fellows and at the same time enhance their own security and prestige.

The aged also find many opportunities to exercise their powers in more formalized religious and ceremonial roles. They serve as guardians of temples, shrines, and sacred paraphernalia, as officers of the priesthood, and as leaders in the performance of rites associated with prayers, sacrifices, feast-days, annual cycles, historic celebrations, and the initiation of important and hazardous enterprises. They are also prominent in ceremonies associated with critical periods in the life cycle—such as birth, puberty, marriage, and death. Although a sharp distinction cannot be drawn between lay shamanism and professional priestly functions, there is in general a difference.

From many detailed and careful studies made on the subject, it can be stated with confidence that belief in and fear of ghosts and unfriendly spirits are practically universal in primitive societies. Few other cultural traits show wider and more regular distribution. Shamanism as an adjustment to occult and mysterious powers that threaten mankind is equally widespread, irrespective of such physical or cultural determinants as climatic conditions, permanency of residence, stage of economic development, form of family organization, or the presence of an organized priesthood. As a means of adjustment for the aged, therefore, recognized and accredited shamanistic practices are about as common as are beliefs in ghosts and spirits.

The development of an organized priesthood, however, seems to be quite strongly influenced, and even determined, by certain cultural factors. The priesthood tends to be less well developed in severe climates; under nomadic conditions; among collectors, hunters, and fishers; and generally where the family system is based upon matrilocal residence and matrilineal descent. Contrariwise, organized priesthood tends to be more developed in favorable climates, and where there are permanency of residence, herding, farming, and a constant food supply. It links with strong chieftainship, government by restricted councils, secret societies, codified laws, the patriarchial family system, ancestor worship, and elaboration of ceremonial rites. In short, organized priestshoods appear as a product of more complex and highly developed social systems, and it is in these that the aged find

the best opportunities for the exercise of priestly functions.

To sum up, it can be stated explicitly that in primitive societies aged men and women are generally regarded as repositories of knowledge and imparters of valuable information, as specialists in dealing with the uncertain aleatory element, and as mediators between their fellows and the fearful supernatural powers. These qualifications operate to give them key positions in a wide range of social activities. They are esteemed as experts in solving the problems of life. They supervise and instruct in the arts and crafts and initiate hazardous and important undertakings, such as housebuilding, boat construction, planting and harvesting crops, and warfare. They are in constant demand for treating diseases, exorcising spirits, working charms, controlling the weather, conjuring enemies, and predicting the future. They are the accredited officiators in great events of life, such as childbirth, child naming, initiations, weddings, funerals, and "laying of ghosts." They also function frequently as leaders at social gatherings and as directors of games, songs, dances, and festivals. In fact, hardly any of the great and critical occasions of life are not presided over and supervised by some aged men or women. Possessing such great influence, they are the chief conservators of the *status quo*. And finally, after death, they are believed to become supernatural agents themselves, still expert in the tried and tested wisdom of the aged, and very jealous of any young upstart who may presume to challenge or change the ancient folkways.

Prestige and Death

Respect for old age seems to result from social discipline, and to rest primarily upon rights which stem from the force of custom or the fear of consequences. Thus opportunities for social status in senescence—as in the sharing of food, the possession of property, the management of the family, the control of important positions in government, and the exercise of prerogatives associated with knowledge, magic, and religion—are largely conditioned by cultural factors. In brief, the evidence indicates that when conditions call for respect for the aged, they generally get it; when these conditions change, they may lose it.

But prestige in old age is a complex subject, involving many aspects of culture; and this makes it difficult to formulate any clear-cut plan for analysis. The problem is further complicated by the fact that certain kinds of treatment of the aged may be considered as either a mark of esteem and sympathy or as a sign of neglect and abuse, depending upon social interpretations and customary standards of propriety. There are occasions, for instance, when the killing of the aged is regarded as a special tribute, a high honor in fact, and something to be anticipated or actually requested by the old people themselves; but in other cases it can be regarded as nothing short of red-handed murder. In any study of treatment of the aged, therefore, careful consideration must be paid to the customary meaning of given experiences for particular cultures and for the parties involved.

Most primitive societies insure some respect for old people—often remarkable deference—at least until they become so "over-aged" that they are obviously powerless and incompetent. But under close analysis, respect for old age is, as a rule, accorded to persons on the basis of some particular assets possessed by them. They may be respected for their extensive knowledge, seasoned experience, expert skill, power to work magic, performance of priestly functions, control of property rights, or manipulation of family prerogatives. They may be highly regarded for their skill in games, dances, songs, and story-telling. They may even receive consideration for their faithful performance of camp or household chores. It is important to note both the extent of general respect accorded to them in old age and the range of existing attitudes which afford "access to homage." Some social systems provide many ways by which the aged can obtain

prestige, while in others the opportunities are much fewer.

To give one example, probably nowhere has age received greater homage than among the Palaungs of North Burma, who attribute long life to virtue in a previous existence. "Old people have happy lives among the Palaungs." No one dares step upon their shadow lest harm befall him. The stool of a father is periodically anointed after his death and a dutiful son often prays: "Thou art gone, my father, but I still respect these things that belong to thee. Give me long life and health, oh my father." It is such a privilege and honor to be old among the Palaungs that as soon as a girl marries she is eager to appear older than her age. "The older a person becomes, the greater is the respect paid her. The young women are expected to do a great deal of hard work along with the girls, such as bringing wood and water to the village before any festival; so married women are a little inclined to make out that they are older than they really are, in order that they may evade the extra work."

The generalization can be made from the study of many tribes that deference to the aged is very common in primitive societies, even as reported by white travelers, traders, missionaries, and ethnographers, who, it may be assumed, tend to be more or less prejudiced by standards of treatment in "civilized society." Respect, or even reverence for the aged may be accorded to very senile persons. But in cases recorded with ample details deference appears to decline when individuals become physically and mentally incompetent and socially useless in actual or imaginary terms.

It has already been noted that some prestige is accorded the aged in social and food taboos. Prestige for them is also reflected in current legends and myths, and it seems significant that in many of these accounts the heroes are portrayed as old, wise, and very important persons. This is to be expected, perhaps, since it is chiefly the aged themselves who relate the stories, have the longest memories, and are the final authorities concerning past events. Probably no one will presume that the old people invent such patriarchal heroes and heroines in order to enhance and glorify their own positions, for such legendary characters are the product of long-existing traditions. But such leading roles can be potential assets to the aged story-tellers, who are thus able to embellish their tales with qualities and inferences which build up their own prestige; and the smart narrators often appear to turn legends and tradition very cleverly to their own advantage, whether for entertainment, instruction, or inculcation of moral precepts. And when the aged relate their own personal exploits, they seem often to exaggerate them.

Examples of the glorification of old age in legends and stories are extremely common in primitive societies. Among the Hopi, for instance, there are many accounts of the amazing powers and exploits of old people. One old gentleman kept the skins of dogs hanging on the walls of his house and compelled them to come down and dance at his pleasure. Other old men were overtaken by a mighty flood, but they simply changed themselves into large birds and flew over the waters. Some old men would mold pinon gum into giant-like figures and endow them with life by singing and breathing upon them. One oldster could, by whistling, summon Star and Cloud deities to appear in person and defend his cause, or he could spit upon his hands and attract skeleton flies who would drink saliva from his moist fingers and then sting to death his enemies. There are also accounts of many evil-minded old people who were greatly feared for their magical powers. They are described as able to bring evil winds, droughts, disease, and famine. It is said that they would often shoot poisoned arrows into people, killing them either suddenly or by slow degrees. They could change themselves into animals at will, pillage and rob the graves of dead women, restore the corpses to life, and then rape them. In fact it is difficult to imagine

anything beyond the power of these legendary old people. And frequent examples are cited in which lack of respect for them resulted in dire calamity to young upstarts.

It is easy to show from the abundance of legends and stories current in almost all primitive societies that the old people are commonly portrayed in "star roles." In general it is the very aged hero or heroine who has controlled the weather, driven away the famine, changed stones into bread, invented warfare, sung the first songs, formulated the sacred rites, and produced fire from the midst of the sea or elsewhere. It is usually an old man or woman who first developed the rhythm of dancing, learned the efficacy of prayer, practiced the art of healing, and discovered the secret of rejuvenation. It is also the old people who have communed with demons and gods, charmed women or beasts, and have been mighty enough to blow great caves into stone cliffs for their dwelling places. Their legendary attributes are power, wisdom, magic, ingenuity, and invulnerability. In their council is safety, in their service success; but woe to the knave who turns away his face and heeds not the voice of experience and age.

Old age is not only glorified in legends and tales; its attributes are even deified in mythological accounts of demons and gods. And it is noteworthy that while the gods may appear either "noble" or "base" in deportment they are always described as worldly wise, very powerful, and—although aged—never stupid or senile. They have acquired the coveted attributes of age without its baneful burdens. They grow old but not too old, and indeed, some have followed cycles of aging and rejuvenation. It would almost appear that the aged have "created gods in their own image," or that the mythologies have accommodated themselves significantly to the aspirations and coveted roles of the old people.

All things considered, perhaps the most striking fact about respect for old age in primitive society is its wide-spread occurrence. Some degree of prestige for old people seems to be all but universal. This is not to imply, of course, that all the aged are honored everywhere, or that honor increases in proportion to age alone. There are usually extenuating circumstances, qualifying conditions, and an opportune period—a "prime of life" in old age—when prestige is obtained; and there are other circumstances under which it is denied or nearly disappears.

It should be pointed out, however, that sex differences are significant. A favorable cultural milieu for aged men exists within a patriarchal type of family organization; where herding or agriculture is the chief means of subsistence; where residence is more or less permanent, the food supply constant, and the political system well regulated; and also where property rights in land, crops, herds, goods and even women are deeply entrenched. Aged women, on the other hand, seem to gain relatively more prestige in simpler societies characterized by collection, hunting, and fishing; and particularly under matriarchal forms of family organization. Their position also seems to be better among farmers than herders. Aged men are able to achieve considerable prestige, even under circumstances normally conducive to elevating the rights of women; but old women are often at very great disadvantage where cultural factors are weighted in favor of old men. Wherever women are respected in old age, men are rarely without honor, but prestige for aged men is no assurance of the same status for women. If either sex loses, it is more likely to be the women.

The closing scene in the drama of senescence is, of course, death. By dying honorably, courageously, and heroically, one gets a final opportunity to inspire respect and admiration; and sometimes one may even be worshipped by his survivors. Vanity thus plays its part even in death; for not only spiritual security, but also post-mortem prestige, is often coveted by persons departing the mundane sphere for the ghostly realm. The young not infre-

quently have the chance to die heroically—as in warfare—but the price is high, for the best of their lives is still before them. When old people die, it is usually in a different way and at the end of a long life, which has its obvious advantage. It is pertinent, therefore, to examine the various means by which primitive societies provide opportunities for old people to achieve through death itself a last full measure of prestige.

To understand such a situation, it is necessary to examine the attitudes which primitive people hold toward death. In many of the simpler societies death generally comes quite abruptly. The necessities of group survival may even require quick and drastic elimination of seriously handicapped persons. Hardships of climate, lack of food, accidents, migrations, and the hazards of warfare and disease force the weaker members to succumb. Moreover, under primitive conditions death strikes children, youths, and persons in the prime of life more frequently than the very old, for relatively few ever get to be old. Thus in many societies death is more commonly associated with youth than with age, and life is more often snuffed out suddenly than left to flicker and fade by slow degrees.

Owing partly to its early, sudden, and unexpected impact, primitive people not infrequently deny that death is a natural and normal event. Even though it is recognized that it must be the ultimate fate of every man, it is quite generally thought to arise from some blunder or oversight, or to be caused by magic and sorcery. Thus countless legends grow up to explain the unnatural origin of death. In general it is believed to have originated accidentally, or as an evil foisted upon man; and one also finds detailed explanations of how the phenomenon of old age, too, entered the world as an unnatural and unfortunate mishap. Thus the naturalness of death, even for the aged, is commonly either denied or reluctantly accepted by primitives.

Furthermore, the conviction is perhaps even more widespread and persistent that remedies are known, or can be devised, for checking the unwelcome onset of age, and for prolonging life, if not for actual rejuvenation. Though the more glowing accounts of rejuvenation are usually set in a golden age long past, or in a very distant future, devices which promise to extend life even a little are rarely left untried.

Such prescriptions are extremely variable. Some confidently seek longer life through prayer and careful observance of rituals and divine precepts. Longevity is also widely regarded as a just reward to those who obey all moral rules. According to the beliefs of the Berber, for example, a man lives longer who always tells the truth; indeed, anyone who lies too much may even beget bald-headed children! The Labrador Eskimo recommend courageous conduct: "He who encounters head-winds will live a long life." An important admonition of the ancient Hebrew runs "Honor thy father and thy mother, that thy days may be long in the land. . . ." Another popular aid to longevity is believed to be the possession of a fetish—a powerful object or word. A Crow woman, for example, keeps a "rattle" which is regarded as "big medicine" and able to preserve her into such old age that "her body will crack when she moves about."

More mundane remedies are also common. To forestall or at least to delay old age, the Xosa in Africa recommend the removal of all gray hairs and frequent marriages with fresh young wives. It is said that a Xosa patriarch with advancing age "takes another wife or concubine and then another to keep up eternal youth for he is never supposed to grow old as long as he can obtain a youthful bride. She, by proxy, imparts her freshness to his withered frame and throws her bloom over his withered brow." Even the Hebrews are reported to have sought out a fair maiden to warm the blood of their favorite king when he was "old and stricken in years."

From such data, which are abundant, it is evident that primitive peoples frequently deny the necessity of death as a

natural event, and maintain that something can be done to forestall old age or at least to prolong life. Furthermore, the conviction is equally strong and widespread, and even more persistent, that although death may destroy the body, no serious damage is done to the spirit or ghost. On the contrary, death may even render it a service, since the spirit—the real essence of a person—may be freed thereby from the bondage of the flesh. In addition, the ghost may return to mortal life by reincarnation; it may undergo a transmigration and become another living creature; or, much more generally, it may continue on in the spirit realm. These beliefs are so nearly universal in primitive societies that they need no special illustration.

Moreover, it is quite generally believed that the life of a spirit can be, under favorable conditions, more noble and desirable than an earthly existence which has become burdensome at best; and, what is more, both self-interest and personal dignity favor the exchange of an enfeebled dotage for an after-life which promises richer rewards. Then there is the additional expectation that as a spirit one's power over mortals will be greatly enhanced. Indeed, it is very widely assumed that in its disembodied state a ghost can expect and demand greater deference and more substantial services—even sacrifices—from mortal survivors. Thus, by the promise of rewards, or the threat of revenge, it is believed that ghosts can enforce their commands on the living. Such beliefs, firmly held, are obviously able to soothe, if not remove, the sting of death; and whether regarded as a natural or supernatural event, death is thus not always looked upon as an unmitigated tragedy, especially for the aged and ailing.

Opportunities for gaining prestige through death are further augmented in some societies by the development of customs and procedures which prescribe appropriate, respectable, and even honorific ways of dying. Not infrequently the occasion and the manner of a man's death are regarded both by himself and by his contemporaries as much more significant than the fact of death itself. Certain tribes prescribe for the aged the precise manner of death which will insure for them future respect and deference. These mortuary prescriptions may even be compulsory for old men and women. In some instances social pressure for a particular type of death becomes so strong that persons who postpone it or cringe from it are regarded as queer, abnormal, or even despicable.

Nevertheless, while dignified and glorious death for the aged is possible, and even sometimes obligatory, such instances are exceptional and require a favorable combination of both personal qualities and cultural circumstances. In the great majority of instances, and over a wide range of cultures, death usually comes in old age as a sad and trying experience, particularly when too long delayed.

Actual neglect or even abandonment of old people is rather common and not necessarily disrespectful. Such practices are well known among North American Indians, particularly nomadic tribes; but they can be found also in certain sedentary agricultural groups. Even the Hopi, who place such a high premium on old age, make a distinction between the useful period of life and the "helpless stage"; and when the latter condition is reached by any person, he or she is apt to be neglected, and sometimes even "helped to die." It is said that in South America the very aged among the Arawak are "stowed away in small corners of the house, neglected, and left to themselves." In northern Europe the Lapps, when moving camp, feel obliged to abandon their sick and very old. In Africa the Bushmen leave their aged and decrepit when moving from place to place; but it is their custom to build little shelters for them; and provide them with firewood, a little food, and a shell or ostrich egg filled with water. The Yakut in Siberia who are without near relatives complain of the treatment they receive from elders. "They begrudge you food, they drive you away from

the fire, they begin to curse you for every little trifle, they do not care for your illness, and so bedded in the corner you die slowly from the cold." In Japan it is an Ainu custom to place very old people in little isolated huts and leave them there until they die. The huts are then burned down and "sent to heaven" for the convenience of the old, or more particularly, in order that the ghosts might not return and prowl in the village.

The available data, although sketchy, leave little doubt that neglect and abandonment are a fairly frequent means of eliminating old and enfeebled persons. To move away and leave behind any permanently disabled and helpless persons has been the simplest, and perhaps the most humane, method of dealing with an inescapable necessity. The practice has probably existed at some time in the past history of every group; and it may recur at any time that conditions become desperate. On the whole, the procedure tends to be discarded under more favorable circumstances; but when associated with fear of the dead, and when established through wont and custom, it often survives long after conditions which once required it have changed.

Neglect and abandonment of the aged are probably related to the custom of exposure of the dying and abandonment of the house in which death occurs. Both of these adjustments are associated in part, no doubt, with fear of the ghost. On the basis of available data, we are probably justified in stating that actual abandonment of old people is not very common, especially since the practice is sufficiently dramatic not to have escaped the notice of investigators capable of recording it. Abandonment of the aged and decrepit, men and women alike, appears to be more prevalent among nomads and among collectors and hunters; somewhat less so among fishers and herders. Wherever groups settle down, rely upon cultivation of the soil, and have an established priesthood—which probably gives them other means of coping with the feared ghosts—abandonment of the aged tends to disappear.

The suicide of old people may result from neglect, abandonment, or any other trying circumstance; and it is sometimes encouraged by custom or by popular belief in an attractive hereafter. On the whole, information concerning such self-destruction in primitive societies is rather meager. Since suicide is always possible as a last resort for harassed mortals, one would expect its occurrence to be reported more frequently, especially for the aged.

The neglect and abandonment of the aged, as well as their suicide, probably provide relatives and other responsible persons with a comfortable rationalization that they are not the actual cause of the death and will therefore not be threatened with revenge by the ghost or other spirits. Such a fear, however, does not always restrain individuals from actual assault on the aged, sometimes for purely exploitative purposes; but this seldom occurs among members of the in-group.

A more common provocation for violent attacks upon the aged is the accusation of witchcraft, and persecutions of this kind often receive social approval. But even this is not found to be nearly as common in primitive societies as one might expect. It should be observed, moreover, that this is not a mode of conduct likely to have gone unnoticed by ethnographers. In a sense it may be said that persecution for witchcraft is a risk accompanying the practice of shamanism, for individuals may bring it upon themselves whenever they fail to produce socially approved results as reputed magicians and wonder-workers. Witchcraft, so viewed, is shamanism gone awry. This may explain, in part, why old women are more frequently persecuted as witches than old men; perhaps they are not as successful in shamanism and in defending themselves against accusations of witchcraft. In general, prosecution for witchcraft almost always imposes upon the suspect a severe social stigma, and often ignominious death. It is certainly not a dignified way to die;

indeed, it is often regarded as the least desirable death anyone could experience.

While old people sometimes suffer the ignominy of death for witchcraft, some societies, as stated above, provide honorable, though abrupt and violent, forms of death for their old folks. Not infrequently relatives and friends regard these acts as deeds of mercy, and it has been indicated already that the aged sometimes welcome and demand them. Although such killing of the aged is by no means common, examples are easy to find.

It is reported that the aged Eskimo are treated with great respect; but it is also stated: "This does not prevent them, however, from putting the old folks out of the way, when life becomes a burden to them; but the act is usually done with the wish of the person concerned and is thought to be proof of devotion." Yet these people expect special compensation for anyone who dies a violent death; he will be transported to the highest heaven, in the vicinity of Aurora Borealis, and there spend his time with other courageous spirits, who have died in like manner, "playing football with a walrus head."

Among the Samoans, to cite one other example, the old people were once buried alive at their own request. It was even considered a disgrace to the family of an aged chief if he were not so honored. "When an old man felt sick and infirm, and felt he was dying, he deliberately told his children and friends to get all ready and bury him. They yielded to his wishes, dug a round pit, wound a number of fine mats around his body, and lowered down the poor old man in his grave in a sitting posture. Live pigs were then brought, and tied, each with a separate cord, the one end of the cord to the pig and the other end to the arm of the old man. The cords were cut in the middle, leaving the one-half hanging at the arm of the old man, and the pigs were taken to be killed and baked for the burial feast; the old man, however, was supposed still to take the pigs with him to the world of spirits. The greater the chief, the more numerous the pigs, the better reception in their hades of heathenism. . . . His grave was filled up, and his dying groans drowned amid the weeping and wailing of the living."

Extensive studies show that violent killing of old people, either enforced or voluntary, is prevalent among quite a number of peoples. But the custom is by no means uniform throughout any wide area of the world—unless it be in the extreme north—and it is improbable that the majority of the aged in any society have been able to attain prestige by this manner of death. Such a dramatic and glorified custom is not likely to have been overlooked or left unreported by any survey; furthermore, the killing of the aged under any circumstances, derogatory or honorific, is an accepted practice in less than one-third of the tribes covered in special investigations.

We may well consider the question: Under what environmental and cultural conditions is the killing of old people most likely to occur, and under what circumstances does such a death contribute prestige to the victims? It can be said with some confidence that killing of the aged is associated more often with environmental and social necessity than with either visions of a bright hereafter or callous indifference or vindictiveness on the part of relatives. In other words, it would seem that abandonment, exposure, or killing of the aged results more often from dire necessity than from personal whims; the hardness of primitive life, not the hardness of primitive hearts, is the basic reason.

Furthermore, the gaining of sympathy and prestige by old people through violent death depends largely upon a combination of physical necessity and a willingness on the part of the old to die courageously. The necessity of such death seems to be in itself no sure guarantee of popular sympathy and prestige; for only in about half of the tribes in which the aged are killed is any special respect or honor indicated. Thus, optimum opportunities for old people to gain glory by violent deaths are relatively rare and

require a certain combination of circumstances and courage: Environmental conditions should make it a necessity; cultural beliefs about life, death, gods and the hereafter should inspire the deed and cushion the blow; established precedent should prescribe the manner of dying and delegate the proper agents to perform the execution. An audience, and possibly a celebration, should attend the ceremony. Finally, aged persons should demonstrate sufficient force of character to accept the hard challenge courageously; and the act should not be put off too long. The very senile who have lost their courage or returned to childish ways have not been able to play very heroic parts.

In summary, therefore, among primitive peoples death in old age follows neither a simple nor a uniform pattern; nor is the role of the aged or their relatives entirely passive. Both the circumstances of and the attitude toward death are extremely variable. In fact, the social significance of dying for the aged ranges all the way from the height of homage to the depth of degradation. Under varying circumstances, and often entirely beyond personal control, an old person who faces death may be neglected, abandoned, cast out, or even killed by his closest of kin; or, instead, he may be protected by them and carried along gently to the very end of life. In these last moments he may be feared or loved, despised or honored, reviled or even worshipped. And he in turn may deny death as a natural necessity, resist it as a curse, submit to it as the hand of fate, embrace it as a golden opportunity, or even demand it as a right. His dying treatment and the way he takes it are conditioned in part by his personal qualities, to be sure, but even more by the impersonal, environmental, and cultural factors of his social milieu. As the records show, a certain cultural context can make it possible for an old person, by confronting death directly, to achieve thereby something of a victory. But a great deal depends on the social situation and the opportunities afforded by it. To die on some occasions is like undertaking a great adventure in state; but on other occasions the approach to death can be no more than a pathetic and ignominious struggle all the way. Thus, in death, as in life, man's fate is decided by the mores of his time and place.

Contrast Between Primitive and Civilized Societies

As noted above, there is more uniformity in the interests of old people in different primitive societies than in the adjustments which are made to senescence. Nevertheless, as we have seen, some degree of order is discernible, varying with the stage of cultural development and physical and social factors. It may be of interest to note the contrasts which exist between primitive societies and our own civilization with respect to old age.

Some of these contrasts are quite obvious. One is immediately struck with the fact that primitive peoples generally have far less exact knowledge than moderns concerning the biological and medical aspects of aging, and so they indulge their fancy much more freely concerning the nature and significance of senescence. They have thus quite reasonably and seriously conceived many mythical, and to us fantastic, accounts of a golden age of perpetual youth, of the unnatural origin of old age and death, of exceptional persons able to escape both of these misfortunes, and of perennial endeavors to find lost or secret remedies for rejuvenation and longevity. In fine, the culturally conditioned meaning and interpretation of old age among primitive men and women is bound to be at variance with modern thought on the matter.

Another contrast that attracts attention is the fact that the average life time in primitive society is short, that most people die in youth or middle age, and that relatively few ever reach old age, whereas among advanced peoples a long life is a reasonable expectation of the average person. Thus old age, a rarity with them, is a commonplace with us. Indeed, a modest

old age may provide a mark of distinction in itself, while in modern society only a centenarian achieves fame by survival. Nevertheless, a small proportion of primitives live to be as old as any civilized men or women, and they often receive considerable distinction. Therefore, although primitive man's chance for long life cannot compare with ours, senesecence is for that very reason more impressive.

This greater distinction of very old people in primitive societies rests not only on the fact that there are relatively fewer of them; those who do manage to survive the rigors of primitive life seem generally to remain much more vigorous and active than old people in modern society. Under hard primitive conditions, weaklings are weeded out all along the line. Moreover, when they become totally helpless and dependent in old age they are soon eliminated in one way or another. In protected civilized society, however, even weaklings are preserved. The keeping alive of enormous numbers of very old and decrepit people is something relatively recent in the history of man. It is not surprising therefore that old age among us tends to be regarded as an unenviable state. And it would be even more so if we learned how to keep old people alive twice as long as we do now! There would be many more old people, and much feebler ones, all in competition with each other and with younger persons for the goods of life.

A further comment should be made concerning the larger proportion of old people who remain active, productive, and even essential in primitive as compared with modern societies. The fact seems to be that many primitive peoples have succeeded amazingly in providing means for utilizing the services of their few old people as long as they are able to move hand or foot in special kinds of labor, minding children, telling stories, executing feats of magic, performing rituals, supplying useful information, and making important decisions. These are all found to be worthy occupations of the primitive aged. Thus the opportunities for an old man or woman to be regarded as a treasured asset to the group are much greater than in modern societies. This is not to say that there are fewer useful functions in civilization that the aged can fill measurably well—indeed the reverse is true—but among us competition with the young is generally much stronger. Indeed, primitive cultures are frequently so well adapted to the capacities of old people that old age can become a more enviable period than the youthful years. The average old man or woman tends to be retired as relatively useless earlier and more definitely in modern civilization than in many primitive societies.

This leads to a further important contrast. The experience of aging in primitive societies seems to be more smoothly tapered and the onset of senescence less abrupt and freer of traumatic transitional phases than in modern civilization. No haunting calendar, no chronological deadline makes each birthday a well-marked milestone on the road to death. This keen awareness of chronological age is a modern experience of aging which has little place in primitive life. The primitive man has his superstitions, to be sure, but the calendar bugaboo is not one of them.

We have seen that another significant contrast lies in the prevailing attitudes towards death, the beliefs associated with dying, and the social significance placed on the manner and means of death. With us it is axiomatic that the very aged are nearing death's door, and their unpleasant preoccupation with thoughts of death are almost taken for granted. But primitive oldsters are not so convinced that age must bring death, and when a patriarch does die, other explanations may be found to account for the catastrophe. It may well be that we, for all the benefits of civilization, are less well prepared to confront death than are primitive men.

One other contrast which is very apparent and of great importance is that generally in primitive societies the cultural context—economic, social, religious, and

domestic—seems to be better geared to the capacities of the aged in primitive society than in advanced civilization, so that they may often continue to function effectively far into senescence. In modern societies, indeed, the basic institutional alignments seem to work largely to the disadvantage of old people. Among primitives expedient adjustments tend to be made by the aged themselves as they grow older, whereas in modern civilization protection for the aged is either insured by planned and legislated programs or by anxious preparations made during youth and middle age, through savings and otherwise.

Thus the question arises whether some serious losses have not come to old people with the advances of civilization. The price of a secure old age must be paid out of the prime of life, and then, in old age, the beneficiaries become functionless hangers-on, who have had their day in the field and are now relegated to the side lines—out of contact with the game of life—with too much time on their hands, and too little to do with it. Like unwanted children, in the way of others, they often come to feel out of tune with time and place. No matter how justly deserving one may be, a safe seat on the side is a poor substitute for an active place in the field. It is the passiveness of old age among us that makes it so unhappy. Modern civilization has added more years to life, but it has left less life in the twilight years.

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ABSTRACT

In primitive societies the average length of life is short, most people die in youth or in middle age; relatively few ever reach old age. Therefore, there are fewer old people and those who do manage to survive the rigors of primitive life generally seem to remain more vigorous than old people in modern society, and often considerable distinction comes to them. Important means of security for old people are their active association with others and assistance in their interests and enterprises. They are regarded as repositories of knowledge, imparters of valuable information, and mediators between their fellows and the fearful supernatural powers. With far less knowledge of biological and medical aspects of aging, they entertain many mythical accounts of unnatural occurrence of old age and death, of exceptional persons able to avoid both of these misfortunes, and of endeavors to find secret remedies for rejuvenation and longevity. Interestingly enough, the proportion of the old who remain active, productive, and essential in primitive societies is much higher than in advanced civilization, for they succeed to an amazing degree in providing cultural conditions which utilize the services of their few old people, thereby giving the old person a greater chance to be regarded as a treasured asset.

RÉSUMÉ

Dans les sociétés primitives la moyenne de longévité est courte; la plupart des individus meurent dans la jeunesse ou dans l'âge moyen; relativement peu atteignent un grand âge. Par conséquent, il y a bien moins de vieillards et ceux qui trouvent le moyen de survivre les rigueurs de la vie primitive, semblent demeurer généralement plus vigoureux que les vieillards dans la société moderne, et très souvent on leur accorde une grande considération. Les importants moyens de

sécurité pour les personnes âgées sont leur active association avec d'autres et l'assistance dans leurs intérêts et leurs entreprises. On les regarde comme des dépôts de sagesse, des sources d'importantes informations, et des médiateurs entre leur semblables et les terribles pouvoirs surnaturels. Parce qu'elles ont beaucoup moins de connaissance des aspects biologiques et médicaux du vieillissement, les sociétés primitives entretiennent un grand nombre d'histoires fabuleuses d'évènements surnaturels à propos de la vieillesse et de la mort, de personnes exceptionnelles capables d'éviter ces deux infortunes, et elles cherchent à obtenir des remèdes secrets pour la réjuvénation et la longévité. Il est intéressant de remarquer que la proportion des vieillards qui restent actifs, productifs, et essentiels dans les sociétés primitives est bien plus élevée que dans la civilisation avancée, parce que ces sociétés réussissent, à un degré surprenant, à procurer des conditions de culture qui utilisent les services de leurs quelques rares viellards et par conséquent, donnent à ces vieillards, une meilleure chance d'être reconnus comme un actif précieux dans la société.

SUMARIO

En sociedades primitivas el promedio de duración de la vida es corto: la mayoría de la gente muere durante la juventud o a una edad mediana; relativamente muy pocos llegan a la vejez. Por consiguiente, hay menos viejos; pero estos, que se las han arreglado para sobrevivir al rigor de la vida primitiva, parecen, en general, más vigorosos que los viejos de la sociedad moderna, y con frecuencia hay entre ellos considerables diferencias. Son factores importantes de seguridad en la vejez su activa asociación con otras personas y la asistencia en sus intereses y empresas. Ellos son considerados depositarios de la sabiduría del grupo, dispensadores de valiosa información y mediadores entre los suyos y los temibles poderes sobrenaturales. Con muy escaso conocimiento del aspecto biológico y médico del proceso de envejcimiento, ellos aceptan y comunican muchas explicaciones místicas de acontecimientos sobrenaturales, relativos a la vejez y a la muerte, a personas excepcionales capaces de evitar tales infortunios, y a esfuerzos realizados para encontrar fórmulas secretas para rejuvenecer y vivir mucho. Es muy interesante saber que la proporción de viejos que se conservan activos, útiles y necesarios en las sociedades primitivas, es mucho mayor que en las civilizaciones avanzadas, debido a su éxito en establecer un sistema o condiciones culturales que les permite utilizar los servicios de sus pocos viejos, otorgándoles así una mayor oportunidad de ser estimados como un tesoro muy valioso.

СВОДКА

В примитивных странах средняя продолжительность жизни низка. Большинство людей умирает в юности или в среднем возрасте, и сравнительно мало людей доживают до старости. Следовательно, там меньше старых людей и те, которые смогли преодолеть трудности примитивной жизни, обыкновенно крепче старых людей цивилизованного общества. Старики там окружены большим почетом. Активная связь с обществом, внимательное отношение и оказание помощи в их делах, дают старым людям чувство уверенности в себе. Их считают людьми знающими, могущими дать ценные указания, являющимися посредниками между людьми и страшными сверхестественными силами. Эти старцы, мало знакомые с биологическими и медицинскими науками о старости, создают разные мифы о необычайных, страшных явлениях старости и смерти, и о людях, умеющих избегать эти несчастья и способных найти секрет омоложения и долговечности. Любопытно, что в примитивных странах активные и необходимые обществу старики встречаются пропорционально гораздо чаще, чем в передовых странах. Окружающая их примитивная среда создает для них такие условия жизни, при которых немногочисленные, оставшиеся в живых, старики могут найти себе применение и, таким образом, чувствовать себя полезными членами общества.

ANSWERS TO QUIZ ON PAGE 59

1. No	4. No	7. No	10. Yes
2. Yes	5. No	8. Yes	11. No
3. Yes	6. Yes	9. Yes	

Your knowledge of the law is excellent (10 or 11 correct), good (7 to 9 correct), average (4 to 6 correct), or poor (3 or less correct).

Involution of Tissues in Fetal Life: A Review

ARTHUR T. HERTIG

CERTAIN ORGANS AND TISSUES RUN A COMPLETE LIFE CYCLE DURING PREGNANCY, APPEARING, FULFILLING THEIR FUNCTION, AGING, AND DISAPPEARING WITHIN A SHORT BUT VARIABLE PERIOD OF TIME. THE EXOCOELOMIC MEMBRANE, FOR EXAMPLE, IS PRESENT IN THE HUMAN OVUM FROM THE NINTH TO THE THIRTEENTH DAY, REACHES ITS PEAK AT THE TWELFTH DAY, THEN RAPIDLY DECLINES. THE YOLK SAC HAS FULFILLED ITS IMPERFECTLY KNOWN PURPOSE BY THE END OF THE EIGHTH WEEK, WHILE THE PLACENTA HAS A DEFINITE FUNCTION FOR TEN LUNAR MONTHS, THEN IS DISCARDED AT BIRTH. DR. HERTIG DISCUSSES THE PROCESS OF AGING IN THESE ORGANS AND THE RELATION OF EMBRYOLOGY TO GERONTOLOGY.

ORDINARILY one does not associate the field of embryology with that of gerontology since the beginning and ending of life would seem, at first glance, to be diametrically opposed. If, however, one regards the fertilized human ovum as a whole, whose origin begins in the respective gonads of its parents and whose extra-uterine life is largely a function of the original vitality with which it is endowed, then it becomes apparent that the problems of embryology and gerontology are more closely correlated. Such a point of view is admirably expressed by the eminent embryologist, George L. Streeter (1) who says, "The importance of quality of the egg, and of course I include both its maternal and paternal elements, is not limited to uterine life. Whether the infant survives its first year depends in considerable part on the original quality of the egg. If they withstand the usual wear and tear of life until between fifty and sixty years they conform to the actuary's expectation of life at birth—and to the embryologists' expectation of the performance of an egg of average quality. It is only the extraordinarily good egg that is still going strong at 80 years, and we see him (or her) do this in the absence of any exquisite hygienic regime or environmental favor."

Streeter further emphasizes that the total quality of such an egg is made up of the quality of the separate parts or organs and that any one of the latter may wear out or age prematurely and cause the individual's death while the other organs are still capable of continued function. Thus this author goes on to state, "It is also probable that degenerative diseases of the heart and blood vessels are to be explained as well by the constitution of the germ-plasm with which the individual started life (that is, the inherited vulnerability of his vascular system) as by the much blamed overwork, overeating, oversmoking and overdrinking, which in other individuals do not result in a comparable damage."

One might infer from this point of view that the relation of embryology to gerontology lay entirely in the realm of quality of germ-plasm and its effect on the extra-uterine life of the individual. That such is not the case is shown by the fact that many fetal organs, or portions thereof, involute or age during intra-uterine life.

Examples of such a process are seen in the development and involution of the pro- and mesonephros, both purely fetal organs, which play a functional role in the development of the embryo. That such a structure probably functions, albeit temporarily, is predicted by Flexner's (2) biochemical studies on the metanephros, (successor to mesonephros) of the fetal pig. This author concluded that "1) In pre-

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secretory stage, cytochrome oxidase is in low concentration and equally distributed between epithelium and stroma. In secretory stage, oxidase increases markedly in epithelium and disappears from stroma. 2) In pre-secretory stage, redox potentials of epithelium and stroma are alike. With onset of secretion, the potential of epithelium rises and that of stroma falls so that a difference of 0.230 volt develops between them." Whether similar studies on the pro- and mesonephros would show similar results or not is impossible to say, but studies such as the above do correlate biochemical changes with morphologic evidence of maturation and function. These biochemical techniques have also been applied by Flexner, Flexner, and Strauss (3) to the developing cerebral cortex of the fetal pig with results comparable to those obtained on the metanephros.

In discussing this matter with Louis B. Flexner he defined aging as "the sum total of those processes in an individual which lead to death." Furthermore, if one considers the rate of aging as including the rate at which morphologic, physiologic, and biochemical changes take place, it is apparent from the studies of Flexner and his coworkers that the individual ages most rapidly when he is the youngest, namely, during the embryonic stage.

The intra-embryonic coelomic tract is yet another structure that has a temporary but distinctly functional life span. Likewise, the cells which form the lens vesicle of the eye involute and are extruded once their function has been completed (Streeter, 4). Were it not for this fact, it would be impossible for light to be transmitted through the crystalline substance of the lens. Another temporary but probably functionally useful structure is the neurenteric canal of the late presomite embryo.

Such examples as the above are given merely to indicate that various structures in the embryo itself have a temporary but functional life span. None of these alterations are, however, as striking as the involutionary processes which go on in the placenta and its associated structures—an organ whose entire life cycle takes place during the intra-uterine life of the individual.[1] It is the purpose of this review to describe and, insofar as is possible, to interpret the major involutionary changes that occur in the placenta and some of its associated structures. These will be considered under the following headings: (1) the exocoelomic membrane, (2) the yolk-sac, (3) physiologic aging, and (4) pathologic aging in the placenta.

I wish to acknowledge with gratitude the cooperation of my various colleagues in the preparation of this review: to Drs. George B. Wislocki, H. Stanley Bennett, and Edward W. Dempsey for allowing me to use the original plates of their respective publications some of which are shown in sections 3 and 4, to Drs. George L. Streeter and Louis B. Flexner for helpful discussion and suggestions with respect to aging in the fetal period, and to Chester Reather and Richard W. St. Clair for making some of the pictures here used. I am furthermore

[1] For the benefit of the non-embryologist who may read this, it should be noted that the placenta, or after-birth, is just as much a part of the fertilized ovum as the fetus or baby even though it is a temporary organ and is cast off at birth.

FIG. 1. A human ovum of approximately 8–9 days of age. It is barely implanted within the endometrium, the epithelium of which is attempting to repair the defect in its surface. The thick trophoblastic shell contains lacunae into which flows maternal blood. The central or chorionic cavity contains a globular, bilaminar embryonic disk to which is attached the recently developed exocoelomic membrane. The latter thus surrounds the small irregular exocoelom designated as EX. Carnegie 8215, section 12-5-1, ×200.

greatly indebted to W. B. Saunders Company of Philadelphia and to Dr. Thomas S. Cullen for their permission to reproduce Figures 1, 2, 3, 4, 5, 8, 11, 31 and 32 from the latter author's book "The Umbilicus and its Diseases." To Dr. E. J. Farris of the Wistar Institute of Anatomy and Biology I am grateful for permission to reproduce some of the illustrations from the various publications of Wislocki, Bennett and Dempsey (see bibliography for references and figures for specific illustrations used).

THE EXOCOELOMIC MEMBRANE

One of the most evanescent structures of the developing chorion (placenta) is the thin mesothelium-like membrane which is present in the human ovum from the 9th to the 13th days (Figures 1–3). This membrane lines the chorionic cavity (except where the latter is bounded by the embryonic disk) during this period of development. Conversely it forms the boundary of the exocoelomic cavity—hence its designation as the exocoelomic membrane. Its presence in the developing primate ovum (macaque) was first described by Heuser (5) in 1932 and more fully elaborated by the same author in 1938 (6). Its presence in the developing human ovum was first noted by Stieve (7) in 1926 in describing the "Werner" embryo although that author interpreted the structure as a yolk-sac. Hertig and Rock (8) in 1941 described two previous human ova of about eleven and twelve days of age, both of which showed extensive development of this membranous structure. In that paper, the authors discuss at some length the problem of whether or not this membrane constitutes the early phase of yolk-sac formation. In the opinion of Hertig and Rock it does not although Lewis (9) intimates that embryos of this age should have a large yolk-sac. Actually the human yolk-sac apparently does not begin to develop until late in the thirteenth or early in the fourteenth day as it does in the macaque monkey as shown by Heuser and Streeter (10) although the exact stage or stages in man have not yet been ob-

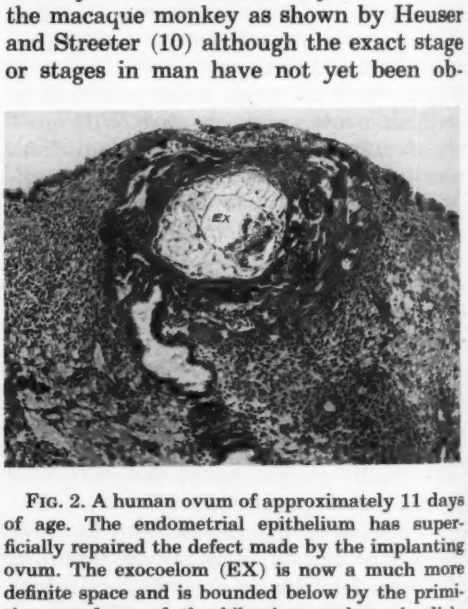


FIG. 2. A human ovum of approximately 11 days of age. The endometrial epithelium has superficially repaired the defect made by the implanting ovum. The exocoelom (EX) is now a much more definite space and is bounded below by the primitive entoderm of the bilaminar embryonic disk. Elsewhere it is surrounded by the sharply delineated exocoelomic membrane. Note the multiple gossamer attachments of the membrane by mesoblastic cells to the surrounding trophoblast from which it originally arose. Carnegie 7699, 8-5-3, ×100.

served. Thus the yolk-sac appears to begin its development about the time the exocoelomic membrane has reached its zenith and is degenerating. For fuller discussion of this problem and the details of the membrane's development see Hertig's (11) recent paper.

For the purposes of this review the development and involution of the exocoelomic membrane may be treated very briefly. The first appearance of this structure is in ova of approximately 8 days of age or in their 9th day of development. Such a specimen is seen in Figure 1. It contains a thin, irregular and in places imperfect membrane within the central cavity (chorionic) of the ovum. Most of the cavity is occupied by the embryonic disk but to the edge of the latter is attached the exocoelomic membrane. It arises from primitive mesoblastic or mesenchymal cells which in turn delaminate in situ from the adjacent cytotrophoblast of the chorion. As the individual mesoblastic cells continue to differentiate, the older ones join with their fellows to form a membrane-like structure. This process tends to separate the central portion of the chorionic cavity—now called the exocoelom—from the remainder of the cavity. Since the exocoelomic membrane is never entirely perfect, the two portions of the cavity intercommunicate—especially in the earlier phases of the membrane's existence.

Figures 2 and 3, of an 11- and a 12-day human ovum respectively, show later and more readily recognized stages in the development of the exocoelomic membrane. These specimens have previously been described by Hertig and Rock (8). In the eleven day stage the membrane is well developed and sharply delimits the exocoelom from the surrounding chorionic cavity although the former is relatively small as compared to the latter. Even in this early stage of development, however, there appears to be a stainable difference between the fluid in the exocoelom and that in the intercellular spaces of the chorionic mesoblast. Thus, the fluid within the exocoelom stains more darkly and with fewer precipitated granules—presumably of protein—than does the fluid outside. Whether this bespeaks a difference in function of the two fluids or not is impossible to say. However, the exocoelom is much more intimately associated with the embryonic disk—being bounded by the primitive entoderm of the latter—so that in all probability the exocoelomic fluid possesses some functional as well as structural significance.

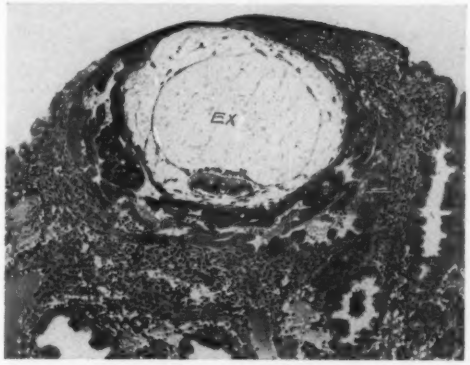


FIG. 3. A human ovum of approximately 12 days of age. The exocoelom (EX) now fills amost the entire chorionic cavity although its membranous envelope is being stretched to near the breaking point as a consequence of which it is becoming thinned out and attenuated. This stage precedes by some hours that of the 13½ day ovum seen in fig. 4 at which stage the exocoelomic membrane has fragmented. Carnegie 7700, section 6-1-5, ×100.

The peak in the development of the exocoelomic membrane is seen in the 12-day ovum (Figure 3). At this stage, the exocoelom is relatively enormous and occupies most of the chorionic cavity. There is still a stainable difference between the fluid within the exocoelom and that outside. In this respect, the present stage resembles that of the previous day (Figure 2). The exocoelomic membrane itself, however, begins to appear thinner and more frayed-out as though the growth of the ovum had stretched it nearly to capacity. That this could be the case is shown by the mesoblastic attachments of the membrane to the surrounding chorion from which it origi-

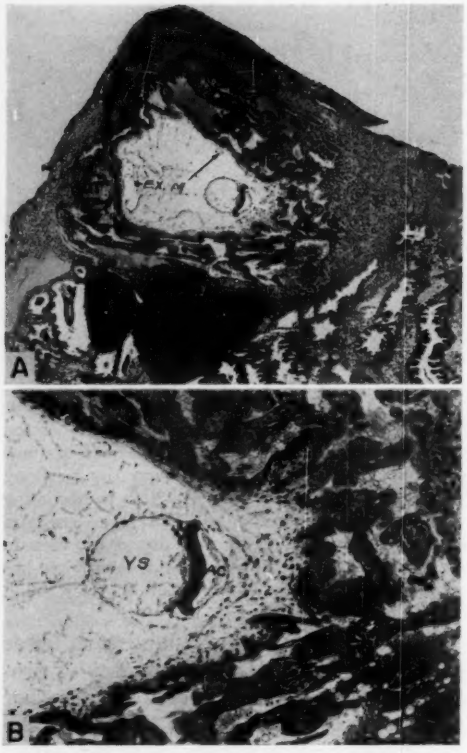


FIG. 4. A. A human ovum of approximately 13½ days of age. The hemorrhagic closing cap is seen above the ovum. The chorion possesses simple unbranched villi. The chorionic cavity contains an eccentrically situated embryo (see fig. 4B for details of the latter) and the remnants of the exocoelomic membrane (EX. M). The endometrium shows an early decidual reaction about the ovum. The gland below the ovum contains extravasated blood. Note large sinusoid in the endometrium to the left of the ovum. Carnegie 7801, section 12-1-1, ×35.

B. Section through embryo of 13½ day human ovum. Note the single-layered yolk-sac (YS) to the left of the embryonic disk and the amniotic cavity (AC) to the right. Note early connective tissue in base of simple chorionic villi. The blood at the right is within the intervillous space of the early placenta. Carnegie 7801, section 12-1-3, ×100.

nally arose. Hence, with continued growth of the ovum as a whole, more and more stress is put upon the gossamer exocoelomic membrane. Whatever the mechanical or functional forces are, the wall of the exocoelom soon bursts—a good deal as though it were a tiny balloon whose stress had exceeded its strain. Unfortunately, no specimens are available, either to the author or in the literature, that depict this cataclysm, although the ova showing early yolk-sac development usually contain remnants of the now defunct membrane. An example of this stage in human development is seen in Figure 4, an ovum about 13½ days of age or its 14th day of development.[2]

Thus does a temporarily useful structure develop, age, and die, all within a life span of 4 or 5 days. That it must perform some physiologic as well as structural function cannot be denied although its exact nature must await further study.

THE YOLK-SAC

As indicated in the section on the exocoelomic membrane, the exact time at which the human yolk-sac begins to develop and the manner in which it arises are unknown. That it undoubtedly develops when the ovum is about 13 full days of age, or in its fourteenth day of development, is shown by the fact that it has not yet appeared in the 12-day specimen (Figure 3) although it is a definite entity in the 13½-day specimen seen in Figure 4. As noted before, Heuser and Streeter (10) have shown that in the macaque monkey the yolk-sac begins to form in the 12-day stage when the exocoelomic membrane is still a well developed structure. Whether the human exocoelomic membrane, by its disruption, assists in the formation of the yolk-sac or

[2] The age of these young specimens is given in terms of developmental or fertilization age rather than menstrual age since the material described up to now was recovered in uteri removed surgically prior to the first missed menstrual period. In older specimens, such as the 23 mm. embryo depicted in Figure 14, the age is expressed in weeks after the last menstrual period. Thus a 21-day ovum, developmental age, is equivalent to an ovum whose menstrual age is 5 weeks or 35 days, since embryonic development does not begin until the 14th day after the last menstrual period at which time ovulation usually occurs.

whether it forms in an independent manner, similar to that of the monkey, must await the securing of specimens of the late 13th and early 14th day.

The youngest human ovum to show a definitive yolk-sac is the famous specimen described by Linzenmeier (12) in 1914. Although this specimen is neither fixed nor stained as perfectly as some of the more recently acquired human ova, it still shows a tiny, cleft-like yolk-sac continuous with the ventral aspect of the primitive entoderm. Remnants of the exocoelomic membrane are present as they are in older specimens of 14–16 days of age. For a pictorial representation of early yolk-sac development the reader is referred to Hertig and Rock's (8) paper on the 11–12 day human ova.

Figures 4 and 5 represent sections from the only normal specimens containing an early yolk-sac which are available to me for study. Complete descriptions of these ova have recently (1945) appeared in the paper by Heuser, Rock and Hertig (13).

The yolk-sac of the 14th day (fig. 4) possesses a single mesothelial layer which in places is beginning to take on added support from the surrounding mesoblast. It resembles the exocoelomic membrane in that it is continuous with the primitive (gut) entoderm of the embryo although it does not possess multiple mesoblastic attachments to the surrounding chorion. This difference in itself would seem to indicate that the yolk-sac is not merely a much-reduced exocoelomic membrane but a new structure entirely.

By the 17th day, the yolk-sac has taken on a typical double-layered appearance (fig. 5). This stage, in general, is characterized by a variable degree of blood vessel formation, although angiogenesis in the chorion (placenta) is moderately well advanced by this time. The reader is referred to Hertig's (14) paper published in 1935 for further details on angiogenesis in the early primate chorion and for a review of the literature on blood vessel formation in the yolk-sac.

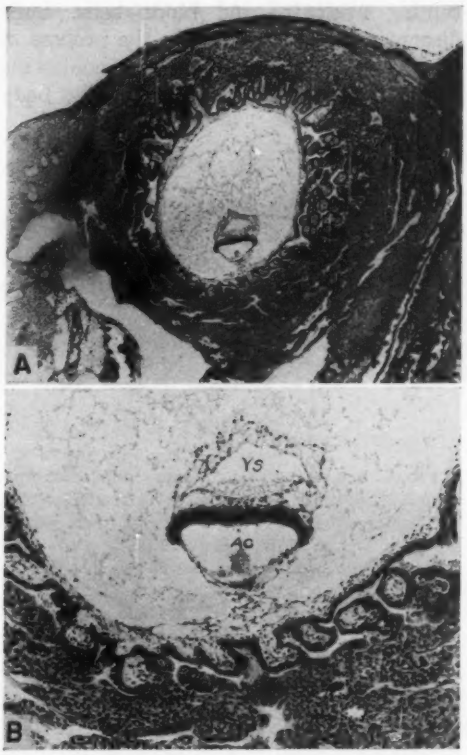


FIG. 5. A. A human ovum of approximately 16½-days of age. The chorionic villi are still simple, unbranched structures. The chorionic cavity contains a normally-situated embryo, the details of which are seen in fig. 5B. No trace of the exocoelomic membrane remains. Carnegie 7802, section 44-3-5, ×30.

B. Section through embryo of 16½-day human ovum. Note double-layered yolk-sac (YS) above and amniotic cavity (AC) below the embryonic disk. The amnion is lightly attached by mesoblastic tissue to the chorionic membrane whose simple villi are continuous with their trophoblastic cell columns. The latter are continuous with the surrounding endometrium although this feature is not seen in this picture. Carnegie 7802, section 44-3-5, ×100.

By the end of the third week, embryos of 17 to 21 days of age (Figures 6 and 7) possess a very prominent yolk-sac whose ventral wall is studded with small isolated blood islands. These structures are composed of thin, capillary-like structures con-

taining nucleated red blood cells. Such discontinuous vessels are in the process of forming a vascular system by coalescing with those in the embryo proper, its body stalk, and chorion (placenta). The superb picture by the late Max Brödel, drawn for Cullen's classic work on the umbilicus (15) shows the general features of such embryos (Figure 6). Figure 7, representing a 1.6 mm. embryo from The Carnegie Embryological Collection, shows an actual specimen of this general age. It is probably about 21 days of age and represents the stage of development just before the blood begins to circulate. Reconstructions of the chorionic vascular system at this stage done by Hertig (14) show that the blood vessel primordia are discontinuous, devoid of blood cells and

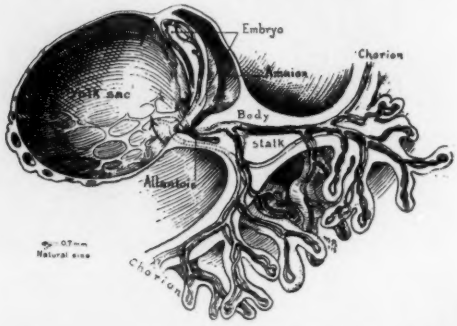


FIG. 6. A drawing of a 0.7 mm. human embryo, about 17 days of age taken from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company. This figure, depicting the right half of the embryonic mass shows the circulation in the yolk-sac, embryo, body stalk and chorion as anatomically complete although later studies show that such a state does not actually occur until about 3 days later. Note the relatively enormous size of the yolk-sac with respect to the embryo and its amnion. Only the portion of the chorion or outer shell of the ovum near the body stalk is represented, the entire chorion at this stage measuring about 8.0 mm. in diameter.

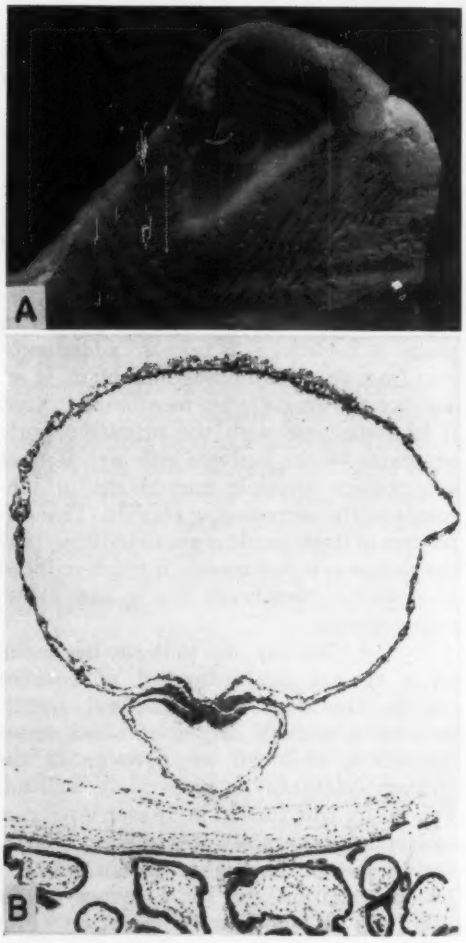


FIG. 7. A human embryo of approximately 20–21 days of age, measuring 1.6 mm. in length. Fig. A. represents the chorion embedded within the endometrium and opened in such a way as to reveal the entire embryo when viewed from its left side. The yolk-sac is the most prominent feature of the embryo and is seen as a balloon-like mass whose distal surface is covered with blood islands. The embryonic disk itself together with its amnion is the thickened opaque mass where the embryo is attached to the chorion. See fig. B. for morphologic details of the embryo. Carnegie 7545, sequence 7, ×5.

Fig. B. A cross section through the middle of a 20–21 day embryo. Note the enormous size of the yolk-sac containing blood islands within its double-layered wall. The embryo proper is the trilaminar mass between the yolk-sac and amniotic cavity and consists, from within outward, of primitive or gut entoderm, mesoderm and ectoderm. A portion of the chorion is seen below. Carnegie 7545, section 6-2-2, ×60.

hence not yet capable of normal circulation.

According to Stieve and Strube (16), who studied the yolk-sac circulation by reconstructing two 17-somite embryos, the blood begins to circulate at about this stage of development, since one of their specimens showed a completed vascular system while one did not. Therefore, since Figure 8 represents a 1.7 mm. embryo possessing 7 somites, originally described by Dandy (17), it is clear that this specimen is just on the border line of possessing a functional circulation. Dandy was not able to show an anatomically complete set of blood vessels in the yolk-sac of his specimen, although it was complete in the embryo and chorion. It is generally agreed, therefore, that in man the circulation begins to function when the embryo possesses from 7 to 17 pairs of somites sometime during its 4th week of development (6th week menstrual age). Several additional examples of this important stage of development are seen in Figures 9–11.

During this phase of active vascularization of the yolk-sac the latter undergoes a

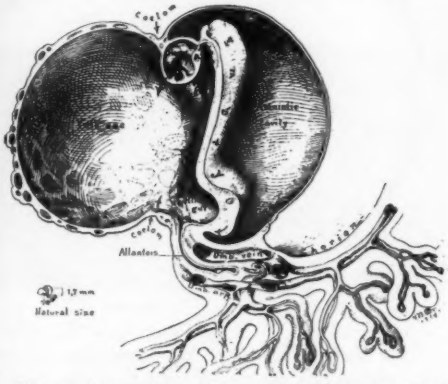


FIG. 8. A drawing of the right half of a 7 somite (1.7 mm.) embryo of the 4th week of development. At this stage, the blood vessels in the embryo, body stalk and chorion are anatomically complete although not quite so in the yolk-sac. The yolk-sac at its junction with the embryo is beginning to constrict and is associated with the invagination of the gut entoderm to form the fore and hind gut. (Fig. 2 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

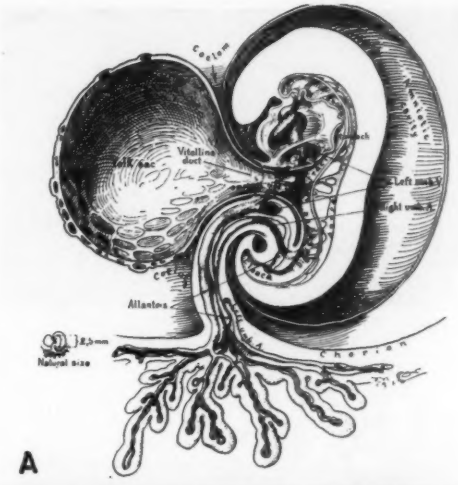


FIG. 9. A. A drawing of the right half of a 2.5 mm. embryo representing a stage in the middle of the 4th week of development. The circulation is complete and the heart functions at this stage. Note the constriction of the yolk-sac to form the omphalomesenteric or vitelline duct as the digestive tract becomes more mature. The growth of the embryo and its surrounding amnion have resulted in the partial approximation of the body stalk and the vitelline duct so that these structures are being combined to form an early umbilical cord. (Fig. 3 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

B. A 3.2 mm. embryo with amnion removed as viewed from below and to the left showing the omphalo-mesenteric duct and its connection with yolk-sac and the primitive embryonic gut. Note the communication between the exocoelomic space around the yolk-sac and the coelom (body cavity) within the embryo. Carnegie 6488, sequence 2, ×15.

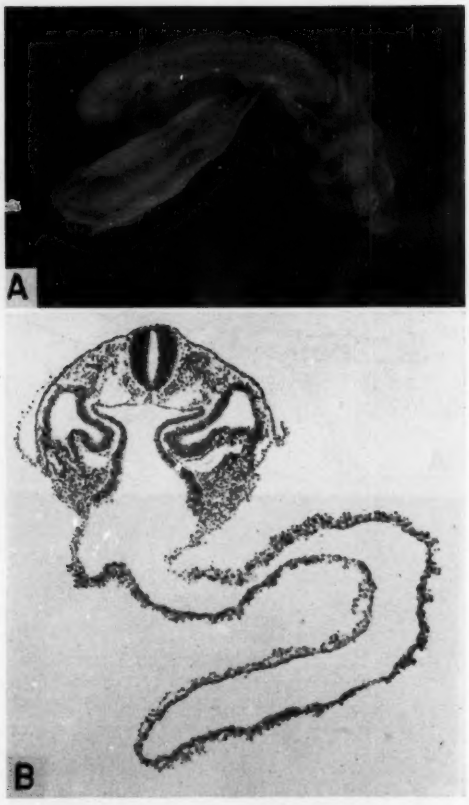


FIG. 10. A. A 3.5 mm. embryo possessing 13 somites and representing the middle part of the fourth week of development. The amnion has been removed so that the approximation of the body-stalk and omphalo-mesenteric duct are less evident than in Fig. 11. This embryo is apparently a little longer than its developmental age would allow because its natural curvature is less, perhaps from having had the amnion removed. Carnegie 6344, sequence 4, ×15.

B. A cross section through approximately the middle of the embryo seen in Fig. A. Note the blood islands and vessels in the wall of the yolk-sac and the communication of the latter with the primitive gut of the embryo. The large spaces on either side of the gut are those of the coelom or body-cavity of the embryo. Carnegie 6344, section 3-7-11, ×75.

complex process of growth and differentiation which results in a portion of its lining (the true gut entoderm—as contrasted to the yolk-sac entoderm) being transformed into the primitive embryonic gut. This series of events can best be followed in Figures 6–11. Figures 7 and 10, representing actual specimens, are best consulted to see the morphologic difference between gut entoderm, a portion of the original embryonic disk, and yolk-sac entoderm which lines the yolk-sac itself and is formed later.

Accompanying the changes which result in the formation of the primitive gut are a series of changes resulting in the growth of the embryo, its assumption of embryonic form and the metamorphosis of the body stalk into a more definitive umbilical cord. The latter results in a gradual restriction and elongation of the connection between the yolk-sac and primitive gut known as the omphalo-mesenteric duct (Figures 9–11). With further growth of the amnion, the omphalomesenteric duct is gradually incorporated into the early umbilical cord as shown in Figure 11.

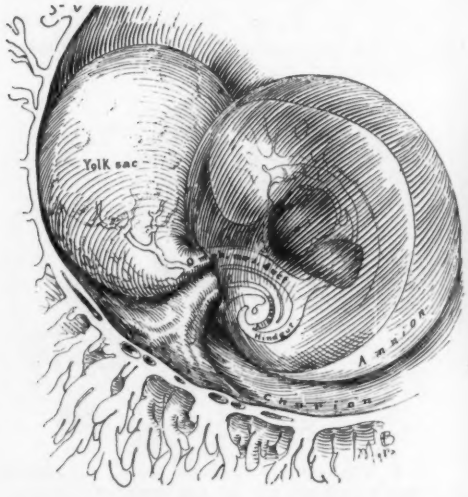
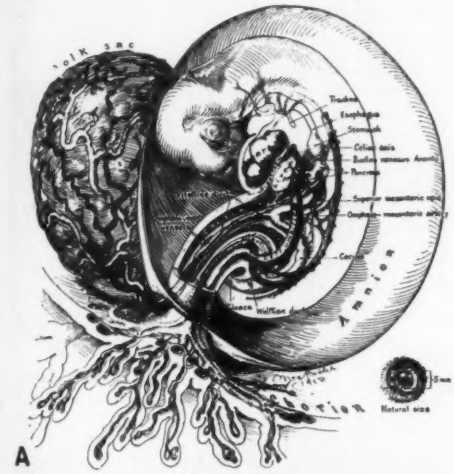


FIG. 11. A drawing of a 3.5 mm. embryo in its 4th week of development—drawn somewhat diagrammatically—to show the further approximation of the omphalo-mesenteric duct and the body-stalk due to the expanding omnion. (Fig. 4 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.) Note that the yolk-sac is now almost as large as the amnion, the former now approaching its period of maximum activity.

In embryos of the late 4th, 5th and 6th weeks of development (6th to 8th weeks menstrual age), the yolk-sac is a prominent structure with an active circulation and a prominent epithelial lining. The latter gives rise to tubular and cystic structures which were investigated by Meyer (18) in 1904. These gland-like spaces, best seen in Figure 12 C, begin to appear in embryos of



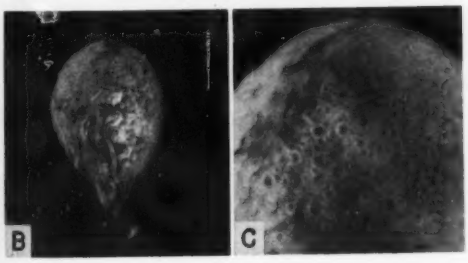


FIG. 12. A. A drawing of a 5 mm. embryo (late 4th or early 5th week of development) showing further development of the umbilical cord. The yolk-sac is large, well vascularized and its wall contains numerous cystic and tubular spaces derived from the lining epithelium. (Fig. 5 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

B. A photograph of the yolk-sac of a 6.7 mm. embryo. Carnegie 7522, sequence 9, ×8.

C. A higher power photograph of the same yolk-sac as seen in Fig. B. to show the numerous cystic and gland-like spaces in its wall. Carnegie 7522, sequence 7, ×22.

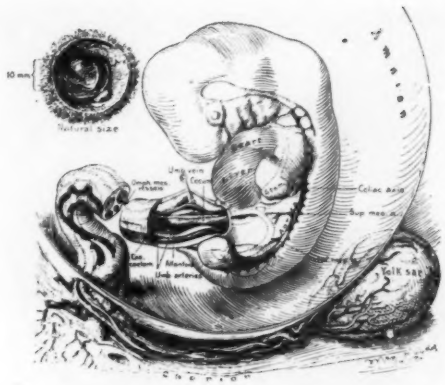


FIG. 13. A drawing of a 10 mm. embryo (5th week of development) showing a more advanced stage in the formation of the umbilical cord and a corresponding attenuation of the stalk of the yolk-sac. The latter is apparently still an actively functioning structure although the stage is being set for its decline in the immediate future. (Fig. 8 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

2–3 mm. and occasionally in younger specimens. However, they are most prominent and are usually present in embryos of 10–20 mm. (5th and 6th weeks of development), two examples of which are seen in Figures 13 and 14. Their function is not understood but, since they are present during the period when the yolk-sac is largest and most prominently vascularized, one must assume that they possess some function. It is probable that they present a much larger surface area of yolk-sac epithelium to the rich vascular plexus than would the epithelial lining by itself. Whether the secretion of the yolk-sac has any specific function or not is unknown, but it probably does because of this mechanism for increased absorption during the period of greatest yolk-sac activity.

After the 8th menstrual week the yolk-sac gradually becomes less vascular, its epithelium degenerates and its shrinking lumen is filled with granular calcified debris (fig. 15 B). Associated with this process is the gradual stretching and attenuation of its stalk (fig. 15 A). The latter may or may not remain attached to the base of the

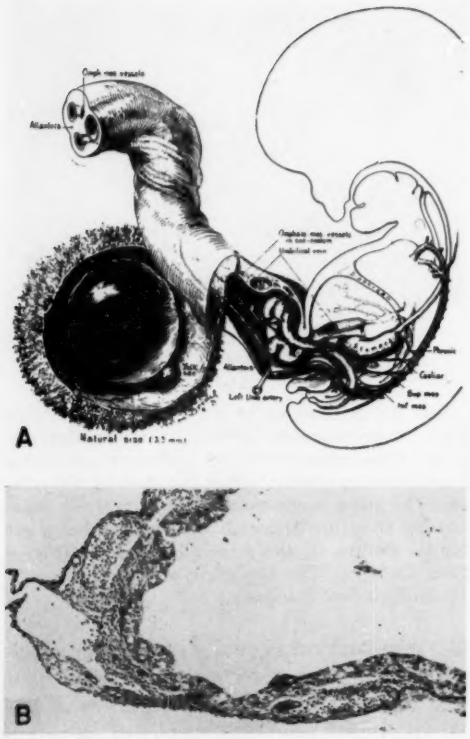


FIG. 14. A. A drawing of a 23 mm. embryo, late in the 6th week of development (menstrual age 8 weeks), showing its yolk-sac lying between the amnion and chorion. The stalk of the yolk-sac is becoming progressively more attenuated although it still contains functioning blood vessels. (Fig. 11 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

B. A section of a yolk-sac whose age is comparable to that shown in fig. A. Note the thick epithelium lining the structure and the congested blood vessels within its walls. B. L-i. H., S-35-835, ×100.

umbilical cord as is shown in Figure 16 A. Actually at term the tiny, opaque, flattened body may be anywhere (Figure 16 B) upon the surface of the chorion—even out on the membranous portion thereof. However, since the yolk-sac always lies within the chorionic cavity—even though that space gradually becomes obliterated—it is universally found between the amnion and chorion.

Thus passes another temporarily useful fetal organ whose functional life span stretches from the 3rd to perhaps the 8th or 9th week of development. What the exact functions of the yolk-sac are is beside the point; it illustrates the fundamental concept that all tissues begin to

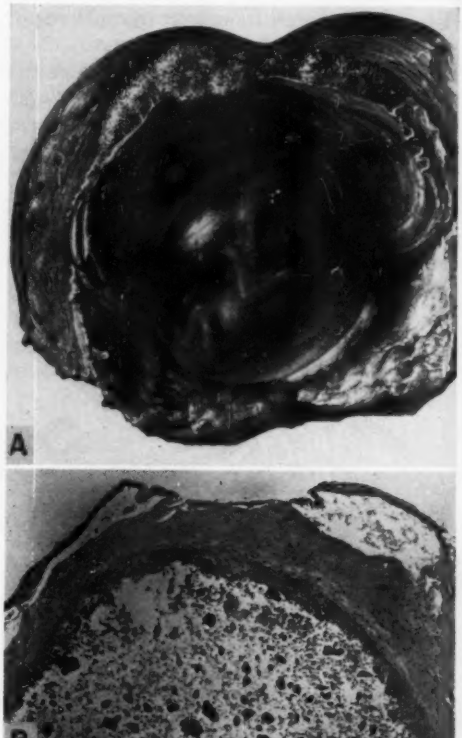


FIG. 15. A. A half-tone drawing, natural size, of a 55 mm. embryo (menstrual age 11½ weeks), lying within its amniotic sac. The chorion and uterus have been opened so as to expose the innermost membrane. The degenerating yolk-sac is seen at the right as a vesicle attached to the base of the umbilical cord by an attenuated strand—the yolk-stalk. (Fig. 31 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

B. A section of a slightly older yolk-sac (menstrual age 14 weeks) to show the thick avascular fibrous tissue wall and the degenerated epithelial lining. The lumen contains granular or amorphous debris which is undergoing calcification. The overlying membrane is the amnion. B. L-i. H., S-35-649, ×60.

age at a variable time after they are formed —some even completing their life cycle before we begin our extra-uterine existence.

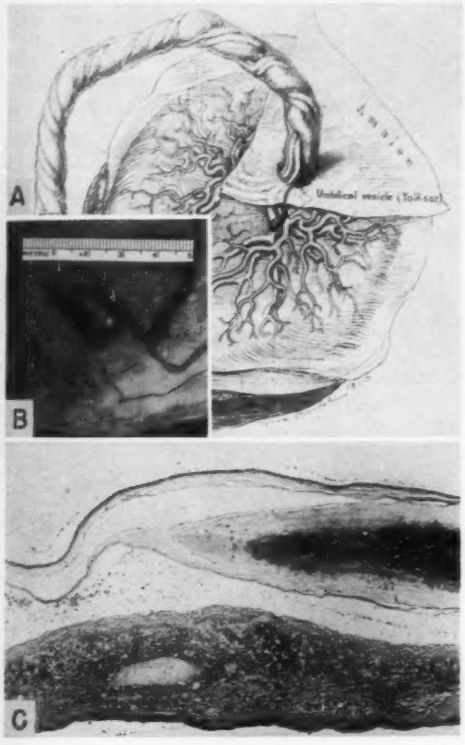


FIG. 16. The yolk-sac at term. A. A drawing, about half-size, of a placenta and a portion of its attached amnion. The yolk-sac, lying between the amnion and chorion, is seen as a pyriform mass attached to the base of the umbilical cord by a thin stalk. (Fig. 32 from Cullen's "The Umbilicus and Its Diseases," W. B. Saunders Company.)

B. A photograph of a portion of the fetal surface of a normal mature placenta showing the characteristic tiny yellow opaque yolk-sac. The latter may lie anywhere within the obliterated chorionic cavity although it often lies fairly near the umbilical cord as shown in Fig. A. Actually this specimen lay near the margin of the placenta—some distance from the cord's insertion. B. L-i. H., Pathological Laboratory.

C. A section of yolk-sac at term showing the characteristic calcified mass surrounded by dense fibrous tissue and lying between the amnion (above) and the chorion (below). B. L-i. H., Pathological Laboratory, ×60.

FIG. 17. A. A cytologic drawing of a section from a 30-day human chorionic villus (Fig. 4 from Wislocki and Bennett, American Journal of Anatomy). The thick syncytium is seen covering the actively growing Langhans epithelium. The loose immature connective tissue contains a thin-walled capillary within which are seen fetal blood cells. Note that the erythroblasts are frequently nucleated. Iron hematoxylin, ×1600.

B. A histologic drawing of a mature human chorionic villus (Fig. 17 from Wislocki and Bennett, American Journal of Anatomy). The syncytium is now much thinner, especially overlying the dilated fetal capillaries. Langhans cells are absent in this section although mature villi still contain a few scattered ones. The stroma is dense, the capillaries numerous, the latter containing many nonnucleated fetal erythroblasts. Mallory's connective tissue stain, ×1600.

PHYSIOLOGIC AGING OF THE PLACENTA

In any discussion of aging in a given tissue or organ, cognizance must necessarily be taken of the morphologic changes associated with normal maturation in the organ. Insofar as possible such changes should be correlated with function. The placenta

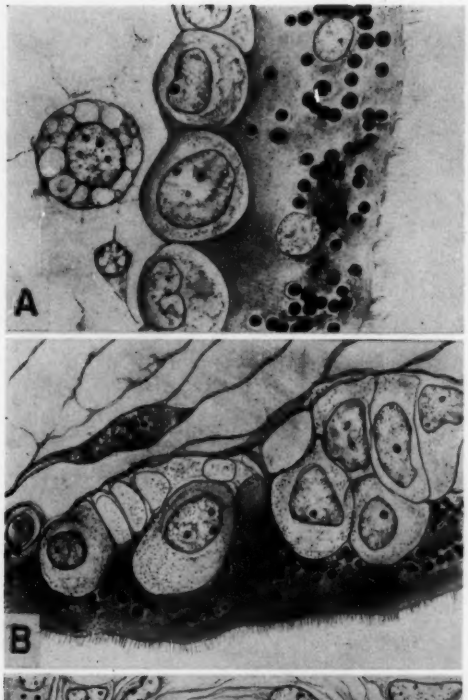


FIG. 18. Lipoid in the syncytium of human chorionic villi at various stages of development (figs. 9, 10 and 21 from Wislocki and Bennett, American Journal of Anatomy).

A. Villus at 30 days, fixed in Champy's fluid but otherwise unstained. Note large black lipoid droplets in the syncytium and their absence in the underlying Langhans cells. A vacuolated Hofbauer in the stroma is seen to the left. ×1600.

B. Portion of chorionic villus from 13-weeks placenta fixed in Champy's fluid but unstained. Note thinner syncytium, smaller lipoid droplets and irregularly arranged Langhans cells. ×1600.

C. Villus at term, fixed in Champy's fluid but unstained, showing thinned-out syncytium which still contains lipoid although in reduced amounts. ×1600.

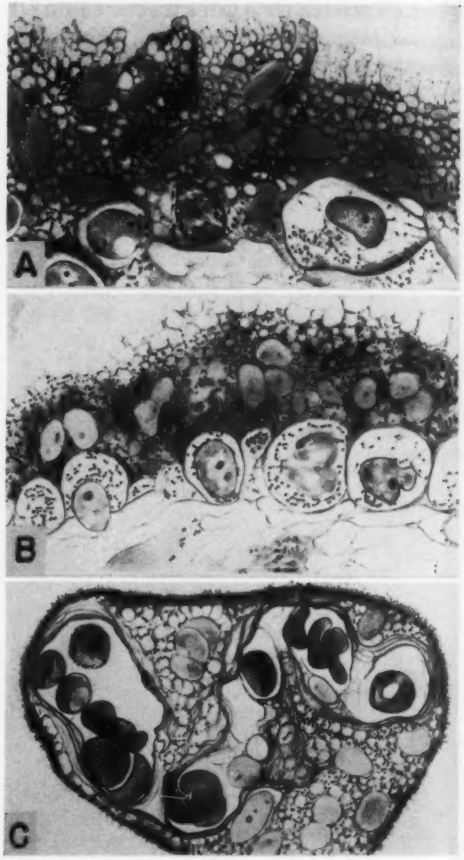


FIG. 19. Syncytium from human placenta at various stages of gestation, stained by the Altmann-Kull method for mitochondria (figs. 13, 14 and 19, from Wislocki and Bennett, American Journal of Anatomy).

A. Villus from 30-day placenta. Note the large numbers of rod-like mitochondria in the syncytium and the lesser numbers in the Langhans cells. ×1600.

B. Villus from 13-weeks placenta showing the continued abundance of smaller mitochondria in the thinner syncytium. ×1600.

C. Villus at term showing continued presence of mitochondria even though the syncytium is very thin. Note fuzzy or "stubble-like" border on surface of villus. ×1600.

lends itself to such studies and therefore the morphologic and function changes associated with physiologic aging of the placenta will be briefly considered.

The most recent and complete histologic and cytologic studies on the maturation of the placenta are reported in the classic paper by Wislocki and Bennett (19). They have kindly allowed me to use some of their original illustrations for the purpose of this review (Figures 17–20).

As a generalizing statement, it may be said that as the placenta matures it forms a larger number of smaller and thinner-walled units, the chorionic villi, by means of which the maternal blood is made more efficiently available to the fetal blood within the placenta. Stated differently, the maturing placenta, in proportion to its volume, presents more of its surface to the maternal blood. These changes are vividly contrasted in Figure 17 which shows the relative thickness of the various layers through which any given substance must go in passing from the maternal to the fetal circulation. Thus in a 30 day placenta (Figure 17 A) a thick layer of syncytium and Langhans epithelium covers a relatively large villus whose capillaries are often at some distance from its surface; whereas at term the villus (Figure 17 B) is much smaller, thinner-walled, more richly vascularized and present in larger numbers.

Functional studies by Flexner and his associates on placentas of different animals (20), as well as in the human (21), have borne out this concept of increasing efficiency as term approaches. Thus Flexner and Gellhorn (20) state, "The rate of transfer of sodium per gram of placenta increases in each animal as gestation proceeds until just before term, at which time there is a sharp decrease. The variation in rate of transfer across the placentas has been correlated with morphologic change in the placenta."

As gestation progresses, the syncytial covering of the villi becomes thinner and thinner, a fact long observed, although its cytological structure has not been fully studied until Wislocki and Bennett's work (19). The syncytium throughout pregnancy contains lipoid droplets (Figure 18) although they become smaller and less numerous as this epithelial structure matures. Wislocki and Bennett (19) in their summary state, "The association in syncytium

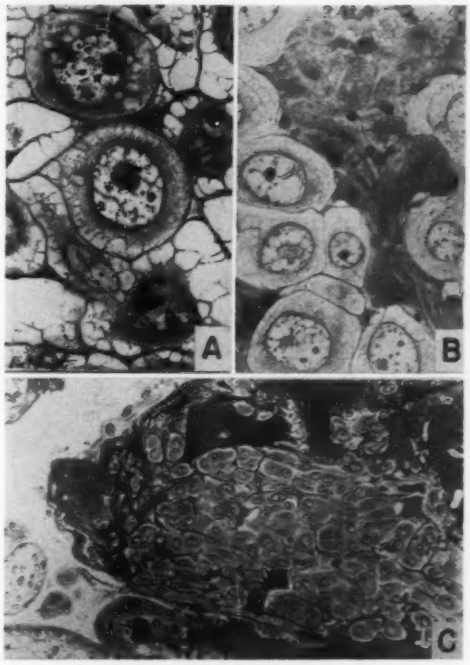


FIG. 20. Cytotrophoblast from human placenta (figs. 27, 40 and 42 from Wislocki and Bennett, American Journal of Anatomy).

A. The cytotrophoblast from a cell column of a 30-day placenta. Note close approximation of vacuolated cells with beginning formation of ground substance between. Iron hematoxylin, ×1600.

B. A panchromatic photograph of a colored drawing made from a cell island of a 13-weeks placenta stained with Azan. The ground substance (originally blue) occupies most of the intercellular space but fibrin (originally red) appears as smaller darker masses throughout this substance. ×1600.

C. A panchromatic photograph of a similar cell island from a 13-weeks placenta also stained with Azan. Note the lighter, larger homogeneous areas of fibrin (originally stained red) and the denser intercellular ground substance (originally stained blue). ×225.

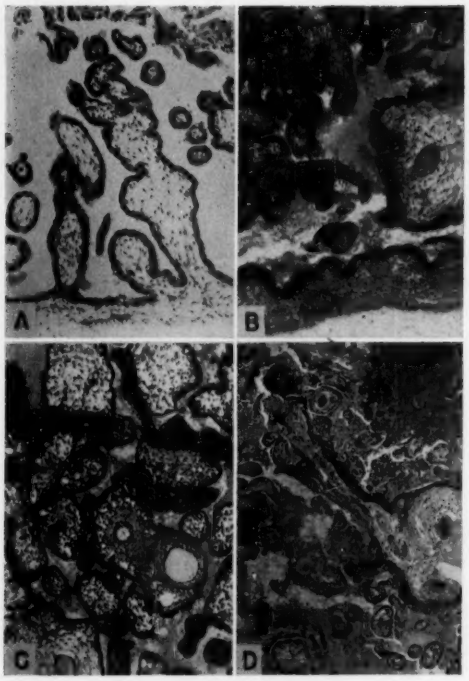


FIG. 21. Human chorionic villi of various ages showing the distribution of gradually increasing amounts of "fibrinoid" as the placenta ages. Note decreasing edema of villous stroma and size of villi as the placenta matures. All villi magnified 100 times.

A. Chorionic membrane and villi of 19-day ovum. Note the loose connective tissue stroma and double-layered epithelium. "Fibrinoid" is not yet present. Carnegie 5960.

B. Chorionic membrane and villi of 11-weeks placenta. Note beginning fibrinoid degeneration of trophoblast in large villus at right. (Figs. B. C. & D. from teaching collection at Free Hospital for Women.)

C. Villi from 16-weeks placenta. Note increasingly prominent dark masses of "fibrinoid" which project from the surface of villi in the upper portion of the picture.

D. Villi from term placenta showing the prominent dark masses of "fibrinoid" associated with the old villous branch running diagonally across the picture.

of fat droplets and birefringent substances soluble in acetone, and of acetone-soluble substances capable of reacting with phenylhydrazine to form yellow phenylhydrazones suggests that the syncytium is the site of formation of placental steroid hormones." The latter include estrogen and progestin. The origin of the chorionic gonadotropic hormone, on the other hand, has been tentatively linked with the placental cytotrophoblast by these authors upon the basis of their own work and a review of the literature.

There has been considerable discussion in the literature as to whether the placental barrier is a pure semipermeable membrane or whether the placenta also has selective ability to pass certain substances and retard or reject others. Wislocki and Bennett (19) review the pertinent literature and conclude from that as well as their own work that the placental barrier is "more than a simple semipermeable membrane operating solely by diffusion and osmosis." In keeping with such a concept is the presence of mitochondria in all stages of syncytial development—even at term (Figure 19) when the syncytium overlying the dilated capillaries has been regarded by Bremer (22) (quoted by Wislocki and Bennett) as being physiologically inert.

As the cytotrophoblast[3] of the placenta matures, certain invariable changes take place with the resultant formation of various amounts of "fibrinoid," or ground substance and fibrin. Wislocki and Bennett (19) have discussed these changes fully, pertinent stages of which are seen in Figure 20. These authors believe that, "this ground substance is a protein-containing fluid of mixed origins, derived mainly from the decidua and maternal blood stream, but also substances released by the cellular trophoblast. This ground substance contains no argyrophile or collagenous fibers.

[3] The cytotrophoblast is the germinal bed of chorionic epithelium from which develops the syncytium, connective tissue, blood vessels and amnion. It is represented at different stages of placental development by: the inner epithelial shell of pre-villous ova (Hertig, 8), the Langhan's epithelium, cell columns and trophoblastic shell of early placentas and the cell columns, cell islands and trophoblastic shell of maturing placentas.

Fibrin becomes variously deposited in it."

This progressive physiologic aging of the placenta is discussed, not only for its intrinsic importance with respect to placental function but also because of its relation to changes of pathologic significance which will be considered in the closing section of this review.

Pathologic Aging in the Placenta

As was pointed out in the previous section, the development of "fibrinoid" or ground substance, together with the resultant deposition of fibrin, is a concomitance of physiologic aging of the placental cytotrophoblast. This substance occurs in the various places where such tissue either has been or persists throughout gestation. It occurs, for instance, as focal accumulations beneath the syncytium of older villi such as seen in Figure 21. Such a locus of deposition represents the site at which the Langhans epithelium had been present earlier, only to disappear with maturation of the villus. Hence, "fibrinoid" is usually found along the main villus stems or major branches thereof—the oldest part of the villus—but is much less common in the small terminal branches that continue to form throughout pregnancy.

Dempsey and Wislocki (23) have shown that as the placenta ages basophilia of the syncytium decreases whereas its alkaline phosphatase increases (Figure 22). Their studies prove that the basophilia is due to the presence of ribonucleic acid, and that such a substance (considered as a phosphoric ester) could be regarded as a possible substrate for phosphatase. These authors therefore suggested as a possibility, "that an enzymatic hydrolysis of ribonucleic acid occurs in the syncytial trophoblast and that the decrease in basophilia as pregnancy advances is caused by its more rapid hydrolysis by the increased amount of phosphatase."

Dempsey and Wislocki indicate further that phosphatase may play a subsidiary role in the calcification of certain portions of the placenta (Figure 23). Such areas follow closely the distribution of the "fibrinoid" deposits described above. Since such areas contain phosphatase as well as glycogen—the latter a readily available source for the production of glyco-phosphoric esters serving as a substrate for phosphatase

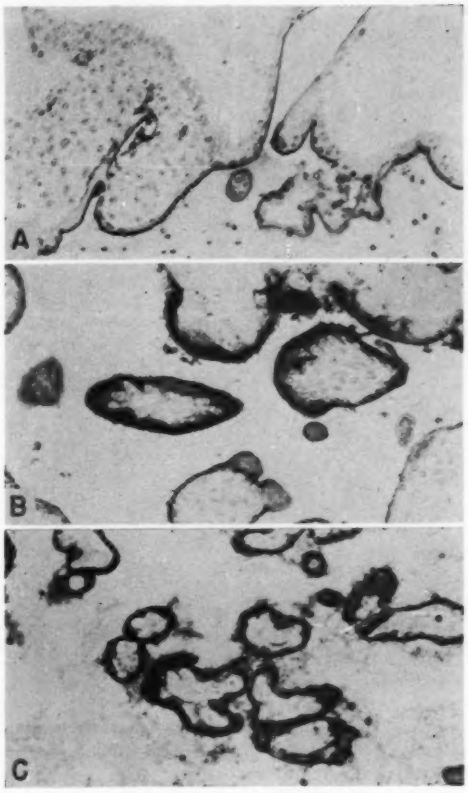


Fig. 22. Chorionic villi from human placentas of various ages to show increasing amounts of alkaline phosphatase in the syncytium as the organ matures. (Figs. 10, 11 and 12 from Dempsey and Wislocki, American Journal of Anatomy.) All villi magnified 235 diameters.

A. Villi of 8 weeks. Note localization of phosphatase to outer portion of syncytium.

B. Villi of 16 weeks. Note rather uniform distribution of phosphatase in syncytium although it is somewhat more dense in the outer portion of the latter.

C. Villi at term. Note that the phosphatase is localized to the syncytium but tends to assume an inner and outer concentration even within that single layer of tissue.

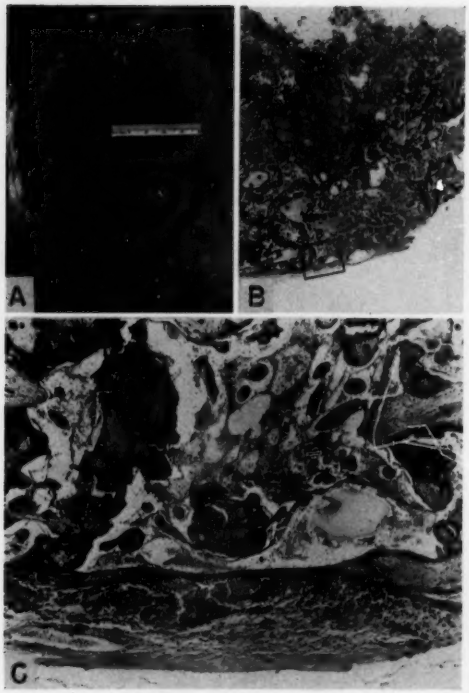


FIG. 23. Calcification in the mature human placenta. Material is from the Boston Lying-in Pathological Laboratory.

A. A portion of the maternal surface of a placenta, photographed under water, to show the fine, lace-like pattern of calcification. About half natural size.

B. A photomicrograph of the entire thickness of a placenta to show distribution of dark calcified "fibrinoid" associated with the larger villous stems. Note that the calcification is present throughout the placenta although its presence adjacent to the maternal surface (lower portion in picture) enables it to be seen and felt in the intact specimen as in Fig. A. ×5.

C. A more highly magnified portion of the maternal surface from Fig. B to show the calcified fibrinoid. This picture represents the portion in Fig. B enclosed in the small rectangle. ×60.

in the calcifying process (Harris, 24) quoted by Dempsey and Wislocki)—the basis is laid for calcification of placental "fibrinoid."

Calcification is not a constant phenomenon in the placenta although its precursor —"fibronoid"—is always found, albeit in variable but increasing amounts from about the 10th week until term. Since it involves the cytotrophoblast and the older supporting elements of the villus, calcifica-

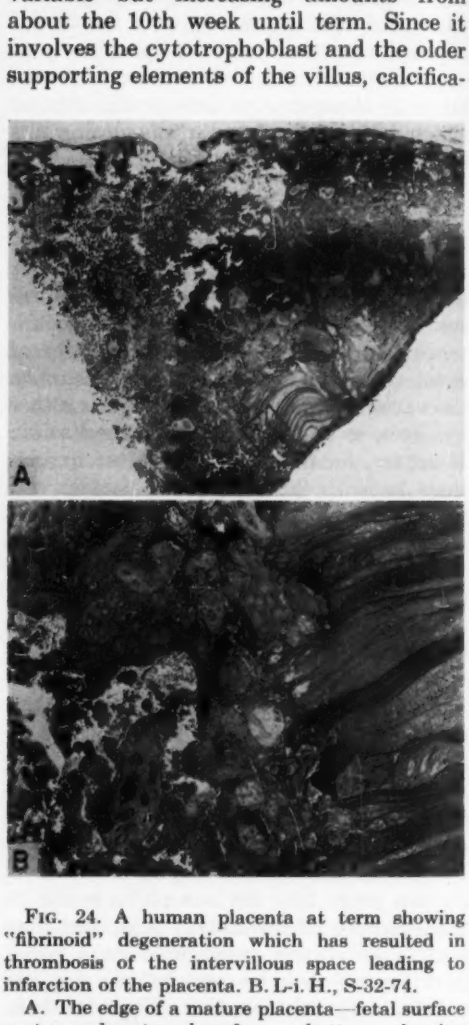


FIG. 24. A human placenta at term showing "fibrinoid" degeneration which has resulted in thrombosis of the intervillous space leading to infarction of the placenta. B. L-i. H., S-32-74.

A. The edge of a mature placenta—fetal surface on top and maternal surface on bottom—showing a laminated fibrin thrombus which appears to have been deposited as the result of "fibrinoid" degeneration of villi and trophoblast on maternal surface. Surrounding the thrombus and spreading out in a fan- or wedge-shaped area is an area of infarcted placenta whose blood supply has been cut off by the thrombosis of the intervillous space. Normal placental tissue is seen beyond. ×5.

B. A higher power detail of rectangular area seen in A. Note "fibrinoid" degeneration in the center, thrombus on the right, necrotic villi at top left and normal villi bottom left. ×60.

tion has no observable effect upon the function of the placenta as the small villi are usually spared.

There are, however, pathological sequelae attendant upon the presence of "fibrinoid" which is apparently the etiological factor in the breakdown of the overlying syncytium. When this occurs maternal fibrin is deposited upon the denuded surface resulting in obliteration of that portion of the intervillous space. This is of frequent occurrence in term placentas although minimal in amount so that no observable harm is done the fetus. If the process is extensive, as it may be on occasion, widespread infarction[4] of the placenta may occur because the circulation through the intervillous space is impaired. A localized example of this sequence of events is seen in Figure 24.

A variant of this process, usually of no significance to the fetus, is the deposition of maternal fibrin on the under surface of the chorionic membrane (fig. 25). Such fibrin plaques are grossly observable as yellow opaque areas of somewhat increased density on the fetal surface of the placenta. On rare occasions this fibrin deposition—really a variety of mural thrombosis—is progressive and obliterates a significant portion of the intervillous space leading to placental infarction and fetal death.

The appearance of cystic foci in the "fibrinoid" of placental cytotrophoblast is another senile change which may produce lesions of pathologic significance. The placental septa, between adjacent cotyledons or lobes of the placenta, are structures composed of variable amounts of such degenerated trophoblast mixed with maternal decidua. Large maternal sinusoids drain the intervillous space of each cotyledon and

[4] Such infarction, it must be emphasized, is not associated with the toxemias of pregnancy whose underlying pathologic anatomy lies in the precapillary arterioles throughout the body. Such involvement of the arteriolar sinusoids of the decidua leads to necrosis of the latter with attendant placental infarction of the toxemic variety. Toxic separation of the placenta is one variety of this pathologic picture.

FIG. 25. A human placenta at term to show diffuse and discrete thrombosis of intervillous space. B. L.-i. H., S-32-217.

A. Laminated fibrin thrombus deposited on under surface of chorionic membrane at left of picture. Note septum running horizontally between two adjacent cotyledons, the lower of which is infarcted due to diffuse and discrete intervillous thrombosis while the top one is normal. ×5.

B. A more highly magnified view of rectangle seen in A. The fibrous tissue of the chorionic membrane is at the top, beneath which is the cytotrophoblast whose "fibrinoid" degeneration has caused the discrete mass of fibrin to be deposited from the maternal blood. ×60.

are often situated at the margin of the latter in the base of the septum. These vascular structures have little intrinsic strength in their own walls but rely upon the surrounding decidua for their main support. Therefore, if a cystically degenerated septum becomes further weakened, with resultant rupture of the sinusoids, a hematoma results and a variety of placental separation follows (Figure 26). (This is an ex-

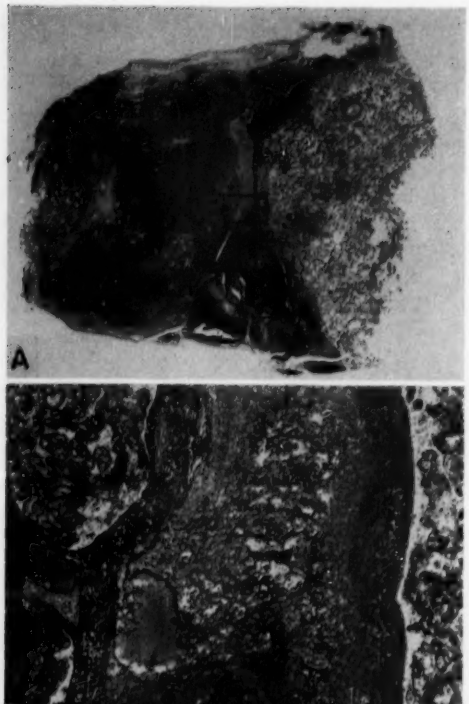


FIG. 26. A human placenta at term to show the cystic degeneration occurring in the "fibrinoid" of a septum separating two adjacent cotyledons. B. L.-i. H., S-34-581.

A. A low power view of two cotyledons separated by a cytotrophoblastic septum whose "fibrinoid" has undergone cystic degeneration. The resultant hematoma at the base has disrupted the blood supply of the cotyledon at the left and caused infarction but has spared the one to the right. ×5.

B. A higher powered view of the rectangular area seen in A. Note degenerated septum with recent hemorrhage below. The villi at the left are congested and undergoing early necrosis whereas the ones at the right are normal. ×60.

ample of so-called "non-toxic" separation of the placenta because it is based upon a senile rather than toxemic basis.) With the disruption of the blood supply to the involved cotyledon, the latter becomes infarcted. It is unusual for this process to become extensive enough to endanger either the mother or fetus.

DISCUSSION

Having attempted to point out that the placenta and various accessory portions thereof show evidence of physiologic and pathologic aging, it remains only to mention certain pathologic examples of delayed and accentuated aging in that organ.

The disease, erythroblastosis fetalis,[5] is an example of delayed aging of the placenta. Presumably the mechanism by which this occurs is the continued and abnormal stimulation of the fetal erythropoietic centers as the result of increased blood destruction. The placenta is a blood-forming organ, and as a result of this urgent need for fetal red cells the placenta continues, until term, a function it ordinarily loses in the first trimester. The placenta of a fetus suffering from the severest form of the disease —universal hydrops—is consequently large, pale, edematous, and friable with microscopic evidence of immaturity and intravascular erythropoiesis (25).

An example of premature aging of the placenta is found in the hypertensive albuminuric toxemia of pregnancy—eclampsia. Tenny (26) called attention to the syncytial degeneration which occurs in the placenta of this disease. Since many of the involved placentas are actually premature, these syncytial changes might be considered as premature senility in that portion of the placenta because the syncytium tends normally to become thin and degenerate as it matures. In keeping with this morphologic alteration of syncytium in the eclamptic placenta are the studies by Smith and Smith (27) of the hormonal changes in this disease. These authors concluded that their "results indicate that this disease of late pregnancy is closely associated with a progressive deficiency of progestin, a concomitant decrease of estrogen and a consequent changed metabolism of estro-

[5] This results from the iso-immunization of the Rh negative mother by the Rh positive fetal red cells and the consequent destruction of the latter by the induced hemolytic antibody in the mother's blood.

gen involving greater and more rapid destruction." It has only to be recalled that Wislocki and Bennett (19) show the origin of the steroid hormones (estrogen and progestin) to be in the syncytium to appreciate the reason for the relative decrease of these hormones in the toxemic patient.

No discussion of placental aging would be complete without some reference to that clinically important condition of postmaturity—the situation in which the patient fails to go into labor at the expected time. Rathbun (28) has recently reviewed the situation at the Boston Lying-in Hospital and finds upon analysis of 250 cases that post-mature fetuses continue to gain weight until the 20th day after the expected date of confinement. After that time they begin to lose weight, suggesting that the post-mature placenta may not be as efficient as it once was. Experimental evidence for this is found in the earlier-quoted work of Flexner and Gellhorn (20) who showed that in animals the peak of placental efficiency with respect to the passage of sodium occurred just before term was reached. It is not surprising, in the light of these and other studies, that nature has created in the placenta an organ whose efficiency does not last long beyond the expected onset of labor.

References

1. Streeter, George L., "Development of the Egg as seen by the Embryologist," *Scient. Monthly*, 32: 495–506, 1931.
2. Flexner, Louis B., "Biochemical Changes Associated with Onset of Secretory Activity in the Metanephros of the Fetal Pig," *Anat. Rec.*, 73, suppl. 2: 20, 1939.
3. Flexner, Josefa B., Louis B. Flexner and William L. Straus, Jr., "The Oxygen Consumption, Cytochrome and Cytochrome Oxidase Activity and Histological Structure of the Developing Cerebral Cortex of the Fetal Pig," *J. Cell & Comp. Physiol.*, 18: 355–368, 1941.
4. Streeter, George L., "Developmental Horizons in Human Embryos, Carnegie Institution of Washington," Pub. 557, *Contrib. Embryol.*, 31: 27–63, 1945.
5. Heuser, C. H., "An Intrachorionic Mesothelial Membrane in Young Stages of the Monkey (Macacus Rhesus)," *Anat. Rec.* 52: suppl. pp. 15–16, 1932.
6. Heuser, Chester H., "Early Development of the Primitive Mesoblast in Embryos of the Rhesus Monkey," Carnegie Institution of Washington, Pub. 501, *Cooperation in Research*: 383–387, 1938.
7. Stieve, H., "Ein 13½ Tage altes, in der Gebärmutter erhaltenes und durch Eingriff gewonnenes menschliches Ei," *Zeitschr. F. mikr.-anat. Forsch.*, 7: 295–402, 1926.
8. Hertig, Arthur T., and John Rock, "Two Human Ova of the Pre-villous Stage, Having an Ovulation Age of About Eleven and Twelve Days Respectively," Carnegie Institution of Washington, Pub. 525, *Contrib. Embryol.*, 29: 127–156, 1941.
9. Lewis, Frederic T., "The Minot Pre-somite Embryo and the Herzog Pre-allantoic Embryo as Elucidating a Still Younger Stage of Human Developments," *Anat. Rec.*, 73: suppl. #2, 36–37, 1939.
10. Heuser, Chester H., and George L. Streeter, "Development of the Macaque Embryo," Carnegie Institution of Washington, Pub. 525, *Contrib. Embryol.*, 29: 15–55, 1941.
11. Hertig, Arthur T., "On the Development of the Amnion and Exocoelomic Membrane in the Pre-villous Human Ovum," Ferris Lecture, Delivered May 2, 1945 at Yale University, *Yale J. Biol. & Med.* In press.
12. Linzenmeier, G., "Ein junges menschliches Ei in situ," *Arch. F. Gynak.*, 102: 1–17, 1914.
13. Heuser, C. H., John Rock, and Arthur T. Hertig, "Two Human Embryos Showing Early Stages of the Definitive Yolk Sac," Carnegie Institution of Washington, Pub. 557, *Contrib. Embryol.*, 31: 85–99, 1945.
14. Hertig, Arthur T., "Angiogenesis in the Early Human Chorion and in the Primary Placenta of the Macaque Monkey," Carnegie Institution of Washington, Pub. 459, *Contrib. Embryol.*, 25: 37–81, 1935.
15. Cullen, Thomas S., *Embryology, Anatomy, and Diseases of the Umbilicus Together with Diseases of the Urachus*, Philadelphia and London: Saunders, 1916.
16. Stieve, H., and I. Strube, "Über die Entwicklung des Dottersackresilaufes beim Menschen," *Zeitschr. F. Mikr.-anat. Forsch.*, 32: 107–175, 1933.
17. Dandy, Walter E., "A Human Embryo with Seven Pairs of Somites, Measuring about 2 mm. in length," *Am. J. Anat.*, 10: 85–108, 1910.
18. Meyer, Arthur W., "On the Structure of the Human Umbilical Vesicle," *Am. J. Anat*, 3: 155–166, 1904.
19. Wislocki, George B. and H. Stanley Bennett, "The Histology and Cytology of the Human

Monkey Placenta, with Special Reference to the Trophoblast," *Am. J. Anat.*, 73: 335–449, 1943.
20. Flexner, Louis B., and Alfred Gellhorn, "The Comparative Physiology of Placental Transfer," *Am. J. Obst. & Gynec.*, 43: 965–974, 1942.
21. Gellhorn, Alfred, Louis B. Flexner, and Louis M. Hellman, "The Transfer of Sodium Across the Human Placenta," *Am. J. Obst. & Gynec.*, 46: 668–672, 1943.
22. Bremer, J. L., "The Interrelations of the Mesonephros, Kidney, and Placenta in Different Classes of Animals," *Am. J. Anat.*, 19: 179–209, 1916.
23. Dempsey, Edward W., and George B. Wislocki, "Histochemical Reactions Associated with Basophilia and Acidophilia in the Placenta and Pituitary Gland," *Am. J. Anat.*, 76: 277–301, 1945.
24. Harris, H. A., "Glycogen in Cartilage," *Nature*, 130: 996–997, 1932.
25. Hellman, Louis M., and Arthur T. Hertig, "Pathological Changes in the Placenta Associated with Erythroblastosis of the Fetus, *Am. J. Path.*, 14: 111–120, 1938.
26. Tenney, Benjamin, "Syncytial Degeneration in Normal and Pathological Placentas," *Am. J. Obst. & Gynec.*, 31: 1024–1028, 1936.
27. Smith, George Van S. and O. Watkins Smith, "Estrogen and Progestin Metabolism in Pregnancy," *J. Clin. Endocrin.*, 1: 470–476, 1941.
28. Rathbun, Lewis S., "An Analysis of 250 Cases of Postmaturity," *Am. J. Obst. & Gynec.*, 46: 278–282, 1943.

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ABSTRACT

There are certain organs and tissues which run a complete life cycle during fetal life. The exocoelomic membrane, for example, is present in the human ovum from the ninth to the thirteenth day, reaches a peak at the twelfth day, then rapidly declines. The yolk sac appears from the twelfth to the seventeenth day, assumes a definite structure, and by the end of the eighth week begins to degenerate until by the time of birth it is only a tiny atrophic structure. The placenta, a highly specialized organ, has a function for ten lunar months, then is discarded at birth. Pathologic aging in the placenta is observed when certain cytological changes pass beyond the normal physiological limits and lead to such phenomena as focal calcification and mural thrombosis of the intervillous space, hematomas, and infarcts. Such diseases as erythroblastosis fetalis lead to a continued immaturity of the placenta because of the continued demand for its function as a blood forming organ. On the other hand, certain toxemias of pregnancy acting through the mechanism of premature senility of the placenta lead to deficiency of the steroid hormone elaborated by this organ.

RÉSUMÉ

Il y a certains organes et certains tissus qui passent par un cycle complet de vie pendant la vie foetale. La membrane exocoelomique, par exemple, est présente dans l'ovum humain, du neuvième au treizième jour, atteint son point culminant au douzième jour, puis décline rapidement. Le sac du jaune apparait du douzième au dix-septième jour, prend une structure définitive, et à la fin de la huitième semaine commence à dégénérer jusqu'au moment de la naissance, où il n'est plus alors qu'une très petite structure atrophiée. Le placenta, un organe très hautement spécialisé, a une fonction pendant dix mois lunaires; puis il est rejeté à la naissance. Un vieillissement pathologique dans le placenta est observé quand certains changements cytologiques passent au-delà des limites physiologiques normales et conduit à des phenomènes comme la calcification focale et le thrombosis mural des espaces intervilleux, hematome et infarcts. Des maladies telles que erythroblastosis

foetalis conduisent à une continuelle immaturité du placenta à cause de la demande continuelle de sa fonction d'organe générateur de sang. D'autre part, certaines toxémies de la grossesse agissant à travers le mécanisme de l'insuffisance prématurée ou de la sélinité du placenta, conduisent à l'insuffisance de l'hormone steroide élaborée par cet organe.

SUMARIO

Existen ciertos órganos y tejidos que desarrollan un ciclo completo de vida durante la vida del feto. Por ejemplo, la membrana "exocoelómica" está presente en el "ovum" humano desde los nueve hasta los trece días, alcanza su mayor desarrollo a los doce días y luego decrece rapidamente. La membrana o envoltura de la yema aparece entre los doce y diecisiete días, se desarrolla completamente, y hacia fines de la octava semana comienza a atrofiarse de manera que al tiempo del parto es apenas una pequeña estructura atrofiada. La placenta, órgano altamente especializado, cumple una función durante diez meses lunares para ser luego descartada a la hora del alumbramiento. El envejecimiento patológico en la placenta es observado cuando ciertos cambios citológicos van más allá de los límites fisiológicos normales y conducen a fenómenos tales como la "calcificación focal" y trombosis mural de los espacios intervellares, hematomas e infartos. Enfermedades como la "erythroblastosis fetalis" conducen a inmadurez continuada de la placenta, causada por la demanda continua de ésta, para llenar su función como un órgano formador de sangre. Por otra parte, ciertas toxemias de la preñez, actuando a través del mecanismo de la deficiencia prematura o senilidad de la placenta, llevan a la deficiencia de la hormona esteroide, elaborada por este órgano.

СВОДКА

Некоторые органы и ткани проходят полный жизненный цикл во время утробной жизни. Например, экзоко-эломическая оболочка находится в человеческом яйце с девятого по тринадцатый день; достигает высоты на двенадцатый день, а затем быстро опускается. Мешок желтка появляется с двенадцатого по семнадцатый день, достигает определенной структуры, и к концу восьмой недели начинает вырождаться и к моменту рождения он является лишь маленькой атрофированной структурой. Плацента — этот столь высоко специализированный орган — имеет назначение в течение десяти месяцев, а затем при родах она удаляется. Патологическое изменение или старение в плаценте наблюдается, когда некоторые цитологические изменения проходят через нормальные физиологические границы и ведут к таким феноменам, как фокальная кальцификация и стенной тромбоз интервиллиозного пространства, кровоизлияния и инфаркс. Такие болезни как эмбриональный эристобластоз ведут к продолжительной незрелости плаценты, ввиду продолжительной необходимости в ее функционировании в качестве органа, вырабатывающего кровь. С другой стороны некоторые токсемии беременности, вызывая дефекты и преждевременную дряхлость плаценты, ведут к недостатку стероидных гормонов, вырабатываемых этим органом.

Professor Edwards Christian died in 1823 in the full vigor of his incapacity.

HENRY GUNNING, in "Reminiscences of the University, Town, and County of Cambridge"

Older people have a passionate, absorbing, almost blood-thirsty clinging to life.

MATTHEW ARNOLD

Shakespeare's Attitude Towards Old Age

JOHN W. DRAPER

THE GREATEST PORTRAIT OF OLD AGE IN ALL LITERATURE WAS DRAWN BY A MAN BARELY FORTY YEARS OLD—AN UNDERSTANDING AND SYMPATHETIC PICTURE OF THE OLD INCLUDING BOTH PHYSICAL PANGS AND PSYCHOLOGICAL ASPECTS. PROFESSOR DRAPER SHOWS HERE WHAT SHAKESPEARE THOUGHT OF THE AGED AND OF GROWING OLD FROM HIS EARLY WRITINGS WHEN HE PORTRAYED ONLY THE PHYSICAL ASPECTS, AN UNSYMPATHETIC PICTURE FLAVORED WITH RIDICULE, TO THE CLIMAX OF HIS CAREER WHEN HE SHOWED COMPLETE UNDERSTANDING AND RESPECT. SHAKESPEARE LEARNED A SYMPATHY FOR OLD AGE SO THAT HE ENDS BY IDEALIZING IT AS MUCH AS HE HAD EARLIER RIDICULED IT.

SHAKESPEARE'S plays are intricate and artistic organisms and require for their understanding many types of background: dramatic structure together with the stage conventions that the audience took for granted, dramatic styles in verse and in prose, and techniques of acting in so far as the records show them. They include the source of the story that Shakespeare used and how and why he changed it to fit his purposes; the organization and economics of companies of actors and the royal or other patronage that governed the theme of their plays; the building of theaters including their date of construction, their size, shape, and arrangement; and so on through a host of matters that scholars have explored and debated during the last two hundred years.

If, however, one may assume that Shakespeare's greatness most inheres in his true and vivid portrayal of human character—that most complex and subtle thing of all creation—then the two most vital backgrounds for Shakespearean research are the social and the psychological. The former expresses man in his outward relations with other men, and the latter in his thoughts and feelings and the workings of his inner life.

For years the present writer and his students have labored in these two fields and have tried to fill in these backgrounds for most of Shakespeare's more complex characters, not on the basis of mere modern guesswork, but according to the social conditions and the psychological theories of Shakespeare's own time, properly documented and carefully applied. Not only individual characters, however, should be treated in this way, but also the evolution of Shakespeare's portrayal of a given type: the constable, the statesman, the choleric soldier, and the melancholy, rejected lover. Somewhat in this latter class the present study belongs; for it proposes to survey Shakespeare's treatment of old age, to define the concept both in contemporary fact and in contemporary theory, to show how he portrayed its physical and its mental aspects, and to trace through the chronology of his plays his deepening insight into a

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state of life that he himself hardly lived to experience.

Drama, especially in the tumultuous days of Queen Elizabeth, generally concerned the young, handsome, active persons appropriate to the roles of soldier, courtier, or prince. Even when, as in *Romeo and Juliet*, parents have a part of some importance, they are presumably not very aged; for, since men married in their twenties and girls in their teens, parents of grown children might well be less than forty. Capulet, though his wife twits him with his years, calls for his sword; and Montague is no less bellicose.

Bad sanitation, however, and neglected personal hygiene even among the better classes shortened life expectancy.[1] Generations were brief. Elizabethans laid aside dancing and tourneys at thirty-five; and, in "the decline of his age" at forty, a gentleman was supposed to hide his bodily decay by retiring from court.[2] Such persons would show some symptoms, at least physical symptoms, of old age and so might be termed "old" by the Elizabethans, for "old" is a comparative epithet.

Many of the characters, moreover, that are described, as "old" or "aged" in the plays are too minor to show either the physique or the psychology of their years. Even so, however, a brief survey of figures described as "old" is in order.

In *A Comedy of Errors*, Adriana calls her husband "old"; but she is speaking in anger, and neither he nor his twin brother show evidence of age. More fittingly, his father Aegeon, is called an "old man"; and Aegeon describes his bodily infirmities:

> O time's extremity,
> Hast thou so crack'd and splitted my poor tongue
> In seven short years that here my only son
> Knows not my feeble key of untuned cares?
> Though now this grained face of mine be hid
> In sap-consuming winter's drizzled snow,
> And all the conduits of my blood froze up,
> Yet hath my night of Life some memory,
> My wasting lamps some fading glimmer left,
> My dull deaf ears a little use to hear . . :

Thus, Shakespeare's earliest depiction of old age, stresses merely its obvious physical symptoms. Old women, since they are hardly appropriate as lovers, are rare in Shakespearean drama; but Juliet's "ancient" nurse may be an example, for she shows some of the characteristics of advancing years. Mistress Ford in *Merry Wives*, though described by her husband as "not young," is certainly not as "old" as Pistol would imply. She gives no evidence of senility! The hurly-burly of the history plays allows little room for the portrayal of old age; but a few vignettes appear: *Richard II* supplies "Old John of Gaunt, time-honour'd Lancaster," always resigned and philosophical, and also the "aged" Duke of York; Henry IV and Henry VIII are depicted at the ends of their long and active lives with some appropriate details; Falstaff refers to Pistol's "old body"; and Falstaff himself is portrayed in the fullness of time and of three plays as he unwillingly "grows old."

Justice Shallow in *Henry IV* and *Merry Wives* is probably Shakespeare's most satiric treatment of old age; but more sympathetically drawn are Adam in *As You Like It* and Nestor in *Troilus and Cressida*. In the Dramatis Personae of *All's Well* Rowe describes Lafeau as an

[1] S. Peller, "Studies in Mortality Since the Renaissance," *Bull. Hist. Med.*, XIII, 427–461 and XVI, 362–381.

[2] J. W. Draper, *The Hamlet of Shakespeare's Audience*, Durham, N. C., 1938, pp. 47–49.

"old Lord." Polonius is "old," though surely very active. Kent in *King Lear* at least borders on "old age," and Lear himself is repeatedly called "old." The folio text of *Measure for Measure* lists Escalus as "an ancient Lord," and the Duke mentions him as "old Escalus." However, the folio text of *Timon* lists "an old Athenian" who turns out to have a daughter who is barely of age to marry! In the *Winter's Tale* Perdita's reputed father is an "old shepherd" who hardly figures in the play. In *The Tempest* "the good old lord, Gonzalo" presents perhaps the happiest picture of old age; but Prospero, though he speaks of his "old brain," seems hardly older than any other father of a marriageable child. Of this odd score of characters, some are very minor and some of dubious age, but several might bear further investigation.

From the Classics came two opposed traditions of old age: from Lucian's *De Luctu*, a tradition that stresses its infirmities and defects; and from Cicero's *De Senectute*, its happier and more pleasing aspects. The swift advent of physical decay would naturally predispose the Elizabethans toward the former; and Shakespeare, especially in his earlier plays, gives repeated emphasis to these unhappy qualities. Aegeon in the passage already quoted details the most obvious matters of physique: a broken voice, pale, cold flesh, white hair, weakness of hearing and of eyesight, and one mental trait, the loss of memory. Also in *A Comedy of Errors*, Adriana complains that "homely age" has marred her beauty. Juliet's nurse, who lacks "warm, youthful blood," has also lost whatever physical charm she ever had.[3] In *Richard II* York is "weak with age," and old Gaunt tells the King that, though the royal mandate can hasten age through sorrow, yet nothing the monarch can do will banish wrinkles. Antonio, likewise, in *The Merchant* refers to the "hollow eye and wrinkled brow" of age. The shrivelled and piping Shallow suggests the last two periods of life as detailed by Jaques in his speech on the seven ages of man:

> The sixth age shifts
> Into the lean and slipper'd pantaloon,
> With spectacles on nose and pouch on side,
> His youthful hose, well saved, a world too wide
> For his shrunk shank; and his big manly voice,
> Turning again toward childish treble, pipes
> And whistles in his sound. Last scene of all,
> That ends this strange eventful history,
> Is second childishness and mere oblivion,
> Sans teeth, sans eyes, sans taste, sans everything.

In *Much Ado*, Constable Dogberry patronizingly describes his colleague Verges: "A good old man, sir; he will be talking: as they say, when the age is in, the wit is out." Hamlet also imputes to old age, along with "grey beard and bleary eyes, a plentiful lack of wit." These suggestions of mental weakness point forward to *King Lear;* and so also, in another way, does the Duke's somewhat cynical remarks in *Measure for Measure:*

> Friend hast thou none;
> For thine own bowels, which do call thee sire,
> The mere effusion of thy proper loins,
> Do curse the gout, serpigo and the rheum,
> For ending thee no sooner. Thou hast nor youth
> nor age,
> But, as it were, an after-dinner's sleep,
> Dreaming on both; for all the blessed youth
> Becomes as aged, and doth beg the alms
> Of palsied eld; and when thou art old and rich,
> Thou hast neither heat, affection, limb or beauty,
> To make thy riches pleasant. What's yet in this
> That bears the name of life?

Even down to his last years, Shakespeare was still concerned with the physical infirmities of age: Cassandra in the *Troilus* refers to "wrinkled eld"; and, in *The Tempest*, age is associated with "cramps," and the old witch Sycorax "with age and envy was grown into a hoop."

To Shakespeare, the psychological aspects of old age were generally its more pleasing side; and he presents these increasingly in his later plays. Even as early as *Two Gentlemen* he associates age with experience and with "eloquence." In *Merry Wives* Mistress Quickly sagely notes that

[3] A. Guido, "The Humor of Juliet's Nurse," *Bull. Hist. Med.*, XVII, 297 *et seq.*

"old folk—have discretion." Not, however, until the middle of his career in the person of Adam in *As You Like It* does the dramatist give a full and sympathetic picture of old age, a picture that stresses its maturity and sweetness of character and its struggle to overcome physical infirmities. Adam is the picture of selfless loyalty: he warns his young master Orlando against Oliver's plots, offers his lord the savings of his lifetime, and asks only to serve him in his exile:

> Here is the gold;
> All this I give you. Let me be your servant:
> Though I look old, yet I am strong and lusty;
> For in my youth I never did apply
> Hot and rebellious liquors in my blood,
> Nor did not with unbashful forehead woo
> The means of weakness and debility;
> Therefore my age is as a lusty winter,
> Frosty but kindly: Let me go with you;
> I'll do the service of a younger man
> In all your business and necessities.

Orlando is not too hopeful for the "poor old man"; and later in the Forest of Arden, Adam nearly dies of hunger and exhaustion. The "honor" due to age appears in Helena's appeal to the Countess in *All's Well* and by inference in *Twelfth Night* when Sir Andrew says that he will not compare himself to an "old man." The "good father," who discusses with Ross the omens at the murder of Duncan, has a memory that goes back, he says, for seventy years; and a store of experience appears in certain statesmen such as Polonius, Nestor, Escalus, and Gonzalo. Lear is a "gracious old man" and one of the most pathetic figures in all drama. In short, Shakespeare portrays both the physique and the mentality of age: among its less attractive qualities, a broken voice, white hair and wrinkles, weakness of limb and sense, various diseases, ugliness of face and crookedness of stature, talkativeness, lack of friends and, above all, illustrated in King Lear, its failing mental powers. The mentality of age, he shows more favorably: it has eloquence and discretion and, in the person of Adam, unselfish loyalty; its long memory makes for wisdom and commands reverence; it can be gracious and at times deeply pathetic.

Shakespeare's earlier pictures of old age, being more concerned with its physical aspects, are generally less sympathetic. The Elizabethans, living in an age without police, when a man's good right arm was his protection against insult or mayhem, had a certain contempt for physical infirmity and for the shifts it was often put to in order to survive. This unsympathetic attitude of the earlier plays is most clearly expressed in the persons of Falstaff[4] and of Shallow.[5] As Falstaff had been a page in the Norfolk household fifty-five years before, he must be over sixty-two, for one usually commenced page at seven; but he admits only to "some fifty" years and declares himself in the "vaward of youth." His associates repeatedly call him "old," and finally he himself is constrained to admit that he "grows old." With wine he tries to heat his blood to youthful fervor. He must play at hale fellow with his patron-prince; for when an Elizabethan soldier showed signs of age, his occupation was gone and he had no recourse but beggery and starvation. Today we should feel the pathos of such a situation; but not so the Elizabethans, who were too much concerned with the calamities of society at large—as portrayed in such a tragedy as *Macbeth*[6]—to waste many tears on mere individuals.[7]

Some critics to the contrary notwithstanding, the present writer follows Professor Stoll[8] in finding little sympathy for Falstaff in the plays: The fat knight is not only an outrageous boaster, a debauchee, an officer who takes bribes and deliberately

[4] Ruth E. Sims, "The Green Old Age of Falstaff," *Bull. Hist. Med.* XIII, 144–157.

[5] J. W. Draper, "Robert Shallow Esq. J.P.," *Neuphil. Mitt.* XXXVIII, 257–269.

[6] J. W. Draper, "Political Themes in Shakespeare's Later Plays," *Jour. Eng. Ger. Phil.* XXXV, 61–94.

[7] J. W. Draper, "Falstaff's Robin," *St. Phil.* XXXVI, 476–490.

[8] E. E. Stoll, "Falstaff," *Mod. Phil.* XII, 197 et seq. J. W. Draper, "Sir John Falstaff," *Rev. Eng. Stud.* VIII, 414–425.

sends his men to death so that he can steal their pay, but, worst of all to the Elizabethans, he is an arrant coward, with only his wit as a redeeming trait. Even older and without wit to redeem him is Justice Shallow, who had been—or at least claims to have been—a gay blade about London some "fifty years ago." He has "lived fourscore years and upward" and long since retired to his estates in the country. He is pompous and boastful and so generally ridiculous that even Falstaff, who is progressing toward his age, makes fun of him. He is wizened with years and yet lecherous; he is avid of honorific titles and yet connives at petty corruption; in fact, he is one of the most satirically depicted figures in all Shakespeare. Indeed, the dramatist, in the fullness of his second period plays, used age in Falstaff and complete senility in Shallow as the very stuff of comic ridicule.

Here and there in the early plays a more attractive picture is evident, for instance in John of Gaunt and in the Duke of York in *Richard II;* but Adam is the first full portrait of a "good old man." He is almost Shallow's age, but hale and hearty for his years, having avoided license in his youth. To Shakespeare Adam represents "The constant service of the antique world, When service sweat for duty, not for meed." In several plays Shakespeare idealizes the feudal classes, the nobles and their "servingmen" and seems to regret the transition to modern capitalistic society. Economic pressure was making life arduous both for nobles like Orlando and for servingmen like Adam; and both were perforce abandoning the chivalric ideals and the liberality and the hospitality that had more or less characterized them in Mediaeval times. Shakespeare's idealization of this "antique world" seems somewhat to have cast its glow on the declining years of Adam.

Such a sympathetic picture of old age appears perhaps in Polonius and clearly in Nestor and Gonzalo. Many critics and most actors portray Polonius as a senile fool; but he is not very old, nor is he by any means a fool.[9] His daughter is of barely marriageable age, and his voice is young enough for Hamlet to mistake it for the King's. Furthermore, with the knowledge he has, the part he plays in political affairs is shrewd enough and accords with all that an Elizabethan would expect of a counsellor of state.[10] He is, in short, clearly Falstaff's junior, a man in his forties or fifties; and, if one call him a depiction of old age, he presents (despite Hamlet's slurring comments that have misled so many critics) a rather sympathetic picture. Of Nestor's many years, however, there cannot be a doubt: He is "old" and "venerable," and "was a man when Hector's grandsire suck'd"; in short, he must be eighty, an old age that the Elizabethans no doubt associated with heroic early times. Achilles calls him "winter"; the dialogue refers to his "white beard," his "silver beard," and his "wither'd brawn"; he speaks of himself as "old" and mentions his "old eyes." Shakespeare's attitude toward him follows the Homeric tradition: He is shrewd in council and "reverend" for his "stretch'd out life."

Gonzalo, likewise, in *The Tempest,* is indisputably "old"; like Polonius and Nestor, he is at times perhaps too talkative; but his terse wisdom and political foresight are not to be despised. Even the flippant Ariel calls him "the good old lord," and the wise Prospero addresses him as "Holy Gonzalo, honourable man." Great age was certainly unusual among the Elizabethans; and, when it occurred, its weaknesses were much in evidence. Shakespeare, when presenting it in a pleasing guise, is dealing either with pastoral unreality as in the case of Adam, or with a long-past heroic period of history as in the case of Nestor, or in a pure romance as with Gonzalo in *The Tempest.*

Late in his work, in the person of King Lear, Shakespeare finally draws a fullscale portrait of extreme old age, showing its

[9] J. W. Draper, "Hamlet," *ed. cit.* Chap. III.

[10] C. R. Sleeth, "Shakespeare's Counsellors of State," *Rev. Anglo-Amèr.* XIII, 97–114.

subtle evolution and the psychological processes involved. A proper understanding of this character requires some grasp of the popular and scientific theories of the time.

The Elizabethans, following the tradition of Aristotle, usually divided man's life into three major parts, and each of these into two or more subdivisions. Of these major parts, old age was, of course, the last. The Mediaeval encyclopedia of Bartholomaeus Anglicus, still popular in the Elizabethan translation of Batman, began *Senecta* at forty-five or fifty, and divided it into old age and dotage.[11] Lemnius, also popular in translation, divided his third period of life into "full ripeness" and "old age," the latter beginning at sixty-three or sixty-five and turning into "dotage."[12] The famous French physician of the Renaissance, Andreas Laurentius, begins old age at fifty and divides it into three parts: "greene" old age, a period of wisdom and prudence like that of Polonius, lasting to seventy; a period of transition; and finally the decrepitude that precedes death.[13] "Dr. Arcandam" approximates Laurentius in his three divisions but suggests that age may set in as early as thirty-five.[14] Cuffe has an entire monograph on the evolution of man's life with much citation of Classical authority and extended reference to astrology and to the humoral theories of Galen. His scheme is generally similar to those of Bartholomaeus and of Lemnius: A period from fifty to sixty-five under the sanguine and fortunate influence of the planet Jupiter, followed by "decrepit old age" under the melancholy and unlucky influence of Saturn.[15] Only "Dr. Arcandam" seems to have enough sense of actual contemporary conditions to begin old age as early as thirty-five. The others are clearly following ancient tradition. Medical writers regularly agree with Cuffe that the latter years of life are astrologically unfortunate; and that the body is dominated by black bile, cold, dry, melancholy humor. This was the humor of bodily decrepitude and mental instability, and it easily gave way to the childishness of dotage. This is the evolution so aptly pictured in King Lear.

Lear is repeatedly called "old"; and, as early as the second act, admits as much to Regan. Indeed, he is "fourscore and upward." He has "white hair," and is "infirm" and is "weak" with age, even before the middle of the play. Physical exposure and "Passions and Perturbations of the Mind"[16] burn out the last remnants of his kingly choler and his vital fluids and leave him cold and dry and weak in body. Lear's mind also soon shows the effect of this decay; and most of his symptoms follow the theories of Lemnius, Cuffe, and other contemporary authorities. Even in act one his "discernings are lethargied"; soon his memory begins to fail;[17] he grows "talkative";[18] he shows a "waiward pettichnesse."[19] As early as the fifth scene he foresees and fears approaching madness, and in act two senses the beginning of *hysterica passio*. In act three his "wits begin to turn," and he complains of melancholy "cold"; and the Fool prophetically declares: "This cold night will turn us all to fools and madmen." By the end of the act his wits are "gone." In the next act he is "mad," and has illusions of sight[20] and raves and imagines Kent and Edgar as judges in a court condemning his two older daughters. Toward the end of act four his cure begins by the medically accepted

[11] *Batman uppon Bartholome*, London, 1582, fol. 70 v.

[12] Lemnius, *Touchstone of Complexions*, tr. Newton, London, 1581 fol. 29 v. et seq.

[13] A. Laurentius, *Discourse of the Preservation of the Sight* (1599), ed. Larkey, Oxford, 1938, 173–174.

[14] *Booke of Arcandam*, London, 1592, Sig. M 2 v.

[15] Henry Cuffe, *Differences of the Ages of Mans Life*, London, 1607, 116 *et seq.*

[16] Burton, *Anatomy of Melancholy*, I, ii, 3.

J. W. Draper, "The Old Age of King Lear," *Jour. Eng. Ger. Phil.*, XXXIX, 527–40.

[17] *Ef.* Lemnius, *op. cit.* fol. 75 v.

[18] Cf. Cuffe, *op. cit.* p. 132.

[19] *Ibid.*, p. 121.

[20] P. Barrough, *Method of Phisick*, London, 1591, p. 58. Walkington, *Optick Glasse of Humors*, London, 1639, chap. xiii; Laurentius, *op. cit.* p. 100 *et. seq.*

means of music[21] and complete rest.[22] But the defeat of Cordelia brings on the final tragedy of his death. Thus Lear is a case history of physical and mental decay brought on by misfortune and advancing years.

Nearly all of these details that give such realism to Lear's senility are Shakespeare's own; for the sources from which he took the story do little more than mention the King's old age. Holinshed's *Chronicle* says merely that he "was come to great yeeres, and began to waxe vnweldie through age"; he does not go insane, but is restored to his throne and rules happily for two more years until his death. The *Mirour for Magistrates* goes a step further and calls him a "doting foole"; but, after Cordelia restores him, he rules "three years in peace." The story in Spenser's *Faerie Queene* refers to his "feeble age" and his "drouping day"; and, after he is restored to his crown, he finally dies "made ripe for death by eld." The old comedy of *King Leir* does little more: "One foot already hangeth in the grave," and early in the play, Lear admits that his "Pale grim death" approaches. He "weeps" at Goneril's ill-treatment and appears exhausted at Regan's court, but he does not go mad as in Shakespeare. At last Cordelia restores him to the throne, and the play leaves him ruling happily.

In short, the depiction of Lear's senility is Shakespeare's own, and this greatest portrait of old age in all world literature was done by a dramatist but little over forty. So much for those critics who insist that all Shakespeare's greatest characters are but aspects of his own biography! Probably Shakespeare first chose the old story because it amply illustrated the dangers of abdication and of division of a realm—two themes especially dear to his patron, James I, who ruled as a God-appointed Divine Right monarch. Moreover, just at this time the King was trying to persuade Parliament to accept complete union with Scotland.[23] The story, therefore, was a combination of these timely themes in the hands of the court playwright. As Shakespeare worked over this material to make it express more strikingly the dangers of abdication and division, he found that they demanded a tragic conclusion; and furthermore, Lear must be extremely old to have motive to relinquish his government. Likewise, if he be so old, his mind and body must break under the strain of accumulated catastrophe. He could not suffer as intensely as the situation required and still return to a happy rule as in the old comedy of *Leir*. Thus the political theme of the play and also the psychological verisimilitude of the title role turned the piece into stark tragedy. Such political errors could not but bring ruin on all concerned, and especially old age could not endure the stress and strain, and so must find an escape in madness and in death.

Shakespeare portrays several stages of man's latter years: Polonius in his forties or early fifties is still a competent prime minister; Falstaff in his sixties still tries to cling to green old age and uses stimulants and bragging and, above all, his wit to pass for a younger man; Shallow and Nestor and King Lear are in their eighties. Polonius falls hardly within the range of the present study, although Elizabethans often showed signs of old age in their forties. Shallow is treated satirically and with emphasis on the physical traits of age. Nestor is idealized as befitted a Homeric hero and sketched but briefly. In Lear is a full-length portrait satire of Falstaff or of Shallow. An understanding and a sympathy for old age apparently grew on Shakespeare; we see Lear as a deeply pathetic figure; and, in Nestor and Gonzalo, wisdom and integrity of character make up for the loss of physical strength. Shakespeare ends by idealizing age as much as he had ridiculed it some fifteen years before. Not only his sympathy

[21] Laurentius, *op. cit.* p. 104.

[22] Lemnius, *op. cit.* fol. 73; Cuffe, *op. cit.* p. 102; Burton, *op. cit.* II, iii, 1.

[23] J. W. Draper, "The Occasion of King Lear," *Stud. Phil.* XXXV, 176–185.

but also his depth of psychological insight grows, perhaps first in Falstaff who shows the fear of advancing years and in Shallow who ludicrously glorifies his youth, but most of all in Lear who bows and breaks before the late storms of life.

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ABSTRACT

The Elizabethan age, a time of bad sanitation, poor hygiene, and early old age, set the customs of Shakespeare's day and the time of his writings. Shakespeare's early pictures of old age dealt mainly with its physical aspects and were generally not too sympathetic. Look at Falstaff and Shallow. Not until the middle of his career did he give a full and sympathetic picture of old age including its maturity, character, and struggle to overcome infirmities. The greatest portrait of old age in all literature was drawn by a man just a little over forty years of age: Shakespeare's King Lear. Here is a full length portrait of an old man including both physical and psychological detail, a pathetic figue of mental and physical decay brought on by misfortune and advancing years. Shakespeare evidently learned a sympathy and understanding for old age so that he ends by idealizing it as much as he had earlier ridiculed it. His psychological insight grew in Falstaff, in Shallow, but most of all in Lear and his sympathy in Adam, Nestor, Gonzalo, and Lear.

RÉSUMÉ

L'âge d'Elizabeth, époque de mauvaise hygiène et de vieillesse prématurée, ère sans assainissement, détermina les moeurs du temps de Shakespeare et de ses oeuvres. Les premiers portraits de la vieillesse chez Shakespeare sont surtout des portraits extérieurs et physiognomiques, peints d'une façon peu sympathique: voir, à titre d'exemple, ceux de Falstaff et de Shallow. Ce ne fut qu'au plein milieu de sa carrière que Shakespeare nous donna un portrait complet de la vieillesse, plein de sympathie pour le caractère essentiel de la maturité, et pour sa lutte contre les infirmités. Le chef d'oeuvre de tous les portraits littéraires de la vieillesse fut composé par un homme qui venait de passer sa quarantaine: c'est le portrait par Shakespeare du Roi Lear. Voici le portrait en pied d'un vieillard, plein de détails psychologiques aussi bien que physiques, image pathétique de la dégénération amenée par le malheur et par l'écoulement du temps. Shakespeare finit donc par sentir pour la vieillesse une grande sympathie et un bel entendement, de sorte qu'au lieu de la tourner en ridicule, comme il l'avait fait auparavant, il en fit un modèle idéalisé. On note chez Falstaff, chez Shallow, et surtout chez Lear les commencements de sa penétration psychologique, mais pour la sympathie il faut attendre les portraits d'Adam, de Nestor de Gonzalo, et encore surtout du Roi Lear.

SUMARIO

La época de la reina Isabel, tiempos de mala sanidad, pobre higiene y envejecimiento prematuro, nos da una idea clara de las costumbres en los días de Shakespeare y del tiempo en que escribió sus distintas obras. En sus primeros retratos describiendo a un viejo, Shakespeare da mucha más importancia al aspecto físico del personaje, y éste, en general, no resulta simpático. No hay más que mirar a Falstaf y a Shallow.

No fue sino hacia la mitad de su carrera literaria cuando Shakespeare dió un retrato completo y simpático de la vejez, incluyendo en él su madurez, carácter y lucha para sobreponerse a sus dolencias.

El más grande retrato de la vejez en toda la litera-

tura, fue hecho por un hombre de un poco más de cuarenta años de edad: es el del Rey Lear, de Shakespeare. He aquí el retrato de cuerpo entero de un viejo, que incluye tanto el aspecto físico como el psicológico, figura patética de una decadencia física y mental causadas por el infortunio y la vejez.

Evidentemente, Shakespeare acabó por simpatizar y comprender a la vejez, de tal modo, que al final la idealizó tanto como la había ridiculizado al principio. Su penatración psicológica se revela en Falstaff y en Shallow, pero sobre todo en Lear, y su Simpatia en Adam en Gonzalo y en lear.

СВОДКА

Елизаветинская эпоха — период плохой санитарии, плохой гигиены и ранней старости — отразился в шекспировском описании нравов и обычаев того времени.

В своих ранних описаниях типов старых людей, Шекспир рисует, главным образом, их физические недостатки в весьма непривлекательном виде.

Фальстаф и Шаллоу являются примерами этого.

Только после первой половины своей писательской карьеры Шекспир дал более полную и доброжелательную картину старости, включая ее зрелость, характер и борьбу против дряхлости.

Самый выдающийся, яркий портрет старого человека во всей мировой литературе был написан автором, которому было немного больше сорока лет — это шекспировский Король Лир. В нем дано полное описание старого человека, включая все его физические и психологические детали; патетическую фигуру нравственного и физического развала, вызванного неудачами и старостью.

Шекспир, очевидно, научился понимать старых людей и симпатизировать им, так как он стал идеализировать их, в то время как в начале своей карьеры он их высмеивал. Начало его сочувствия и психологического понимания можно видеть в Фальстафе и в Шаллоу, но больше всего в Лире, который потерял на старости лет все свои умственные способности и физические силы.

AGEING OR AGING?

The major determining factor in a decision of whether or not to retain the terminal *e* of "age" in the present participle or other derivatives is the pronunciation of the root word. The *e* after the *g* influences pronunciation of the *g* as a *j*. If an ending or suffix beginning with a short *e* or *i* is added, the pronunciation of the *g* is uninfluenced, and the *e* is superfluous and may well be dropped. The only objection to deletion of the *e* is that the root word is reduced to two letters, an objection which is not valid. In the Journal of Gerontology the word will be spelled "aging" (see A Manual of Style, University of Chicago Press, p. 73).

CURRENT COMMENT

The Fountain of Youth

Man, since the beginning of time, has sought the fountain of youth. Even in ancient Egypt a transcriber of a treatise on medicine and surgery, now known as the Edwin Smith Surgical Papyrus, jotted down some notes on old age, the caption of which is reproduced at the top of this page.

The Precolumbian Indians of the West Indies had a legend of the land of the "Bimini," wherein there was a fountain, the waters of which had marvelous cuvative powers. Ponce de Leon, while Governor of Porto Rico, heard the legend and set sail with three ships to find the fountain. Although he failed in his original purpose, he did discover "The Island of Florida."

Even our American comics took cognizance of the fountain of youth when a few years ago Mandrake the Magician exposed a pseudo-rejuvenation scheme.

It is evident to those who understand the principles of life and death that the life of a single individual is not immortal. Our efforts must be directed to prevention of the diseases and infirmities of age so that life in those years may be happier. The Fountain of Youth of Ponce de Leon and the Book for Transforming an Old Man into a Youth of the Early Egyptians were explorations for something beyond their reach, explorations into the great unknown.

What kind of fountain of youth are we seeking: A fountain that will miraculously erase the wrinkles of age, or a fountain that will make the later years of life a health and intellectually occupied period? Truly the expression on the front cover gives the modern attitude toward the quest for the fountain of youth—"To add life to years, not just years to life." To this end The JOURNAL OF GERONTOLOGY is dedicated.

The Real and the Realizable

War is a relentless driver. Survival of the people and of the nation hangs by a thread and there is the cry of "On to greater effort! Do not overlook anything! There is not a second to lose!" The laborer, the business man, the scientist are all sucked into the whirlpool of utilization of every fragment of knowledge. Under the stress of conflict, in five short years, have come the first splitting of the atom, radar, planes with a range of 5,000 miles, and bombs guided to the target by television sets in the nose, to name only a few of the more spectacular and destructive. On the constructive side are penicillin, D.D.T., greater cooperation between nations, and the hope of a lasting peace in the United Nations Organization.

The establishment of the JOURNAL OF GERONTOLOGY has been made possible by a grant from the Josiah Macy, Jr., Foundation in support of the editorial office.

The hieroglyphics, "The Beginning of the Book for Transforming an Old Man into a Youth," at the top of this editorial page, are from the Edwin Smith Surgical Papyrus, translated by Professor John Breasted, University of Chicago Press.

Through the ages, pure science has been years, decades, or centuries ahead of applied science and the harnessing of nature for the benefit of man. Today the nuclear physicists have presented to man the overwhelming force of atomic energy before the social and political interrelations of nations are ready. Whether it takes the latter a decade or a century to catch up may well determine the fate of the next generation.

It is the same story with the results of medical research. Only in the last thirty years has anything approaching the full benefit of vaccination against smallpox been realized. Yet, Jenner demonstrated the efficacy of the procedure in 1798. In World War II the completely attainable values of modern preventive and curative medicine were unfolded by the Armed Forces. The application of these techniques to large parts of the world may well change the economic position of countries and continents.

Day dreaming and planning for the future should not exclude the job to be done in the present. With simple arithmetic we may calculate the effect on life expectancy today if there were full utilization of medical knowledge under optimum conditions. The real—in 1938 the chance of a newborn child living to age 50 was 81.7 per cent. The realizable—86.7 per cent. In other words, with no additional facts, but only acceptance of what is known, another 5 per cent of children may live through the most productive period of life.

Why can not the will to live, the chance to survive, be as strong in peace as in war? Support measures to promote health, which is only one aspect of happiness.

The Debt of the Survivors

Dr. Louis I. Dublin, third vice-president and statistician of the Metropolitan Life Insurance Company, has stated that "thirty per cent of the persons who have attained the age of 65 today owe their survival to the advances in medicine and public health as well as in general public welfare which have been made since they were born." (University of Pennsylvania, Bicentennial Conference.)

The basis for this conclusion is a new method of analysis of life-table data; a comparison of expected survivorship of a large number of babies born at some time in the last century, under mortality conditions then prevailing, with what actually transpired among them in the period of their lifetime.

For example, of 100,000 babies born in England in the year 1876, mortality rates at that time predicted that 42,000 would survive to the age of 50. But, as the years passed, mortality decreased and 53,000 actually were alive in 1926. This was a saving of 11,000 lives or 20 per cent.

If the same calculation is made for age 65, the net increase of survival is 30 per cent. This is the real contribution of pure and applied science to the economic and social welfare of a nation. But research is expensive. Men and women must be trained. Expensive equipment and supplies must be available. Two atomic bombs cost two billion dollars, a billion dollars apiece. Even in war this is a large sum. But someday when atoms are split in engines and not in bombs, the price will be considered cheap.

It is an accepted principle in business that some of the profits are "ploughed back" for development and expansion. The people of a nation and of the world constitute the sum total of all business. Thousands are alive, happy, and productive today because in the past a relatively few had a consuming curiosity to unravel the laws of nature, and a relatively few others were willing to give them a financial "stake."

The attitude of "let John do it" cannot continue forever. The great fortunes and foundations have made and are making a contribution. Recently attacks have been made on two diseases by national groups supported by small gifts such as the March of Dimes, infantile paralysis, and cancer.

The man and woman 50, 65, or 75 years

old in 1946 might say, "I am alive today because someone in 1900 gave money and time to support research on a better way to treat pneumonia. Perhaps if I were to give a little now, my children in the year 2000 will be happier, healthier, and more prosperous than I am." The interest in mental satisfaction on an investment in the future is far greater than the interest in dollars on an investment in the present.

When Old Age Begins

The editor has been asked many times in the last year when old age begins. Or, the more practical inquired, "Reports of investigations of patients beyond what age are acceptable for publication?"

The answer to the first question may as well be the expression "a man is as old as he feels." A more dynamic form of this thought was given by Fibber McGee when someone made a disparaging remark about his gray hair—"Just because there's a little snow on the roof doesn't mean the fire's out in the house." But, more seriously, gerontology is concerned with all aspects of aging. The changes need not occur in the chronologically older animal organism. Witness the involution of tissue that occurs during fetal life discussed by Hertig in this number, page 96.

Extension of Social Security

According to a United Press dispatch of August 14, 1945, Congress will soon be asked by President Truman to make the social security act "a more perfect instrument for the maintenance of economic security."

Reports from Federal Security Administrator McNutt show that $9,000,000,000 in social security payments have gone to individuals since the act was signed in 1935. The ten year total of payments comprises $900,000,000 under old age and survivors' insurance.

The President stated, "Social security has become an essential part of the American way of life. But while we have made progress, we still have a long way to go before we can truthfully say that our social security system furnishes the people of this country adequate protection. Social security worthy of the name is not a dole or a device for giving everybody something for nothing. True social security must consist of rights which are earned rights—guaranteed by the law of the land."

Surgery for the Aged

A more progressive outlook toward surgery for the aged, the result of great advances in medicine, should begin to take the place of the old pessimistic view on the part of both physician and family, according to Louis Carp in his article in *Hygeia* for August, 1945.

"Old age does not necessarily prevent surgical procedures which may save or prolong life, produce continued physical comfort, and add economic, functional, and social usefulness."

Advancing years usually bring on degenerative diseases which affect human tissue in many ways. The heart, blood vessels, lungs, liver, kidneys, bladder, and brain are perhaps the most often affected. Speed, gentleness, and good judgment are essential during an operation on an old person. Often if the person's condition cannot stand too long an operation, it is possible to complete it at a later date, says Mr. Carp.

The human life span has been increasing until in another fifteen years life expectancy should reach seventy-five years. Because the life span is increasing, surgery for the aged is creating a greater challenge for doctors. Old people should adopt a more hopeful outlook toward surgery because of the great advancements in modern methods and scientific practices. This whole program calls for cooperation on the part

of old people when a condition demanding surgery arises.

Shaw and Beveridge

July 26, 1945 saw George Bernard Shaw chalk up his 89th milestone busy as ever on his plays, one of which soon will be seen on the screen. After his birthday silence Mr. Shaw said of the new Attlee Government, "I shall not inflict my congratulations on the Labor ministers. They have come into an unholy mess of bankruptcy and ruin." To Sir William Beveridge, defeated candidate, he had an I-told-you-so: "His defeat will teach Sir William that the Liberal who goes out of his way to disavow Socialism is doomed."

Toward a Longer Life

Our increasing span of life in America has been influenced materially by successful attacks on many of our hazardous diseases until today life expectancy reaches sixty-two years. The extension of known methods of disease control is capable of definitely increasing that span even more, say J. Arthur Myers and Virginia L. Dustin in an article, "Toward a Longer Life," in *Hygeia* for May, 1945.

Most of that which has been accomplished toward increasing the life span has been brought about by controlling diseases in younger age periods, especially childhood.

The study of old age and the diseases pertaining to it has been receiving considerable attention of late, say Mr. Myers and Miss Dustin. Many of the conditions of declining years are not adequately understood and there is still some question as to whether or not they will ever be completely controlled. However, many of these conditions even now can be treated so as to prolong life.

"There comes a time in the life of every living being when, after passing the height of vigor and vitality, degeneration begins. Man passes through years of growth and reaches the height of his strength and power with every manifestation of physical and mental; however, there comes a time when proof of degeneration and decline appears.

"While the span of human life has been definitely extended and may be further increased by the prevention of diseases which have taken their toll among the young, it seems doubtful that science will ever be able to thwart nature when the time comes for degeneration and death. Indeed, it is not death in old age that we lament or are trying to prevent; it is the prevention of death before people have had opportunities to enjoy life and make their contributions to the world."

As to the question of over-populating the world by increasing the life span, according to the authors, the day is coming when man will live happily and comfortably in the tropics and it will become the center of world wealth, civilization, and population.

Basic Wants of Older People

According to Leo W. Simmons, the four general basic wants of all old people include (1) to live as long as possible, (2) to remain active participants in group and personal affairs, (3) to safeguard any prerogatives acquired in long life, such as skills, rights, and prestige, and (4) to withdraw from life as honorably as possible. In his article, A Prospectus for Field Research in the Position and Treatment of the Aged in Primitive and Other Societies, appearing in the *American Anthropologist*, vol. 47, no. 3: 433–38, 1945, Mr. Simmons stresses the need for more detailed and extensive studies before it is possible to draw any good picture of the aged in primitive societies. However, he does say that the onset of old age in most primitive societies was more gradual, with more opportunities for old people to make and continue to make contributions. See the article by Professor

Simmons on page 72 of this number of the JOURNAL OF GERONTOLOGY.

Employment Opportunities

According to a survey of personnel and employment managers of manufacturing and retail concerns by the Family Economics Bureau of the Northwestern National Life Insurance Company, older people will find much broader employment opportunities in the postwar era than they found in the prewar period.

Although many concerns have deep gaps in their 20–30 age group of employees and will recruit intensely in this age group to maintain a balance, the old hard and fast age limitations have been pretty thoroughly broken down and will stay so in many fields.

"Age? We don't put so much importance on it any more," said one employment manager. "Some people act younger and are more alert and vigorous at 50 than other people at 25 or 30."

Many employers who have had unsatisfactory experiences with irresponsible young employees during the wartime labor shortage express a definite preference for older workers, who may take a bit longer to train, but who are faithful, loyal, and dependable. In the office and store fields, women employees dominate the picture; older office women were generally reported surprisingly adaptable, a bit slower at learning, but more reliable than youthful applicants.

Older workers are generally divided into two groups by personnel and employment executives: those between 40 and 50 and those over 50. Reports show that those employees in the 40–50 bracket are adaptable, learn fairly quickly, and are satisfactory almost anywhere in a plant. Regular employees in this group were the mainstay of many concerns during the war and are definitely superior to the youthful wartime personnel available. Their records of sickness and absenteeism were almost as favorable as that of the younger group.

A typical report from a large Cleveland war goods factory shows that, of employees over fifty, 75 per cent of the regular employees did their work well. However, many of the women employees in this age group could not stand the extra pressure of wartime production. New employees of both sexes in this group generally had to be placed in carefully selected jobs where they did not have to lift weights, and were not exposed to heat or smoke. Absenteeism and turnover in this age bracket have generally been high.

In department store work, most workers over 50 cannot be on their feet for any length of time and therefore are placed in such jobs as wrapping, marking, taking phone orders, and other jobs where they can be seated and which do not require much pressure.

One St. Louis department store manager stated that although they would recruit heavily in the younger age brackets in order to balance the personnel, they will no longer have fixed age limits. "Individual qualifications will determine acceptance or rejection."

One Chicago executive, however, had an opinion somewhat contrary to the general report. Said he, "Against a generally satisfactory experience with older employees, we have found that where an older woman, married, and without previous business experience is given her first job in our store, she almost invariably upsets her entire department in a few days with personal gossip."

Live Long and Like It

An exhibit, "Live Long and Like it," augmented by the Cleveland "Golden Age Hobby Show" on display November 15 to December 10 at the Cleveland Health Museum, proved one of the most popular ever shown there.

The exhibits showed the increasing proportion of older people to the total population and portrayed the economic status of

many of the old people, as well as their opportunities for recreation.

Exhibits prepared under the direction of Dr. Bruno Gebhard, director of the Cleveland Health Museum, included: More People Live Longer, Population Over 65, the Four B's: Baldness, Bifocals, Bridges, and Bulges, Our Organs Do not Age Simultaneously, Prevalent Chronic Diseases, Social Security, Jobs After 50?, How Grandma Helped on the Home Front, Food as You Like It, Youthful Old Age, Social Clubs and Recreation, and Institutional Care.

If any evidences were needed for the worthwhileness of an exhibit directed to the older age group, the Hobby Show furnished it. More than 1,200 exhibits were displayed by 235 exhibitors. Practically every craft and domestic science was represented.

Mr. Lawrence K. Frank, director of the Caroline Zachry Institute of Human Development, spoke at the opening exercises. (See page 1 of this issue for an article by Mr. Frank.) He premised his talk on the fact that there has been a three-fold increase of people over 65 since 1900. "Old age security, through pensions and retirement allowances, is a first step but not enough, since it may only intensify the tragedy of old age if not accompanied by more and better adapted facilities for medical and health care, for mental health and personal guidance, for leisure time pursuits, for housing and community planning, and for worthwhile activities which will permit aging people to maintain their feeling of independence.

"There need be no pessimism about aging, since today we have immense new resources, new knowledge, techniques, and skills, and a new understanding of nutritional requirements of the aged.

"Here is where there is an imperative need for guidance to help each individual man and woman plan a design for living which will include the kind of activities each likes and can do—hobbies, arts and crafts, anything in which they can feel they are competent and can still master situations and handle material."

Fun at Sixty

After an elderly woman in Philadelphia committed suicide for apparently no reason other than that she was lonely and had nothing to occupy her time, a minister of the Christ Methodist Church took hold of the problem. (*Everybody's Digest*, January, 1946, condensed from *Christian Advocate*.) Enlisting the aid of the Philadelphia Council of Social Agencies, he established the Golden Age Club, a recreation center to combat the ravages of old age. Its regular weekly meetings, financed by the churches, offers movies, book reviews, hobby programs, picnics, and boatrides. But more important, it offers elderly people a place to go, something to do, and something to look forward to each week. It gives them a chance for companionship, recreation, and something to do besides brood over their troubles or past memories.

One elderly man brings each week a neat little bundle tied in a newspaper. It is his mending which the women gladly do for him. Since his wife's death there had been no one to do such things and they were left undone.

Weekly postcards, sometimes the only mail a member receives, are sent to everyone announcing the next program.

Similar clubs in all communities are well worth consideration by private groups and government.

Personal

It is customary for retiring editors to sing a swan-song in words on the editorial page. The happy associations of ten to thirty years are recounted, and the assistance of many is gratefully acknowledged.

All human undertakings recapitulate the life of man himself; the idea is conceived; there is a period of gestation or planning;

and, finally, the great day of birth, followed by a long stage of growth or expansion.

Although this issue, Volume 1, Number 1, of the JOURNAL OF GERONTOLOGY appears for public view in the winter of 1946, the preceding months and years of gestation deserve recognition before the editor retires. The day of conception was in February 1944, when a committee of the Club for Research on Ageing was appointed to investigate the desirability and feasibility of publication of a journal. Quickening occurred on February 9, 1945, as the committee reported that life could be discerned and suggested that an editor-in-chief be appointed.

During the past eleven months the editor has received encouragement and advice from many. The members of the committee on publications, Roy G. Hoskins, Lawrence K. Frank, Edward Stieglitz, and William deB. MacNider, the consultants to the editor, and those on the advisory editorial board have given generously of their time and thoughts. The authors of the papers in the early numbers have in some way crowded more hours into the twenty-four to complete their contributions. The publishers, Charles C Thomas and Payne Thomas, have never wavered in their cooperation and enthusiasm. The assistant to the editor, Peggy Bronson, has entered into the spirit of the project and contributed much. The significance of each section has been expressed with pen and ink by Mary Lee Rice, who designed and executed the special headings.

All of these with the editor may be looked upon only as associate obstetricians. The obstetrician has been, and the pediatrician for early infancy is the Josiah Macy, Jr., Foundation. Without the sympathetic understanding and support of the Foundation and its medical director, Frank Fremont-Smith, the diagnosis might have been just pseudocyesis.

PUBLISHER'S ACKNOWLEDGMENT

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ORGANIZATION section

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ROBERT A. MOORE, *Treasurer*
507 South Euclid Avenue
St. Louis 10, Missouri

Certificate of Incorporation of the Gerontological Society, Inc.

Pursuant to the Membership Corporations Law

We, THE UNDERSIGNED, of full age, being desirous of associating ourselves together for the purpose as hereinafter more particularly described, pursuant to and in conformity with the Membership Corporations Law of the State of New York.

Do make, acknowledge and file this certificate as follows:

1. The name of the corporation shall be Gerontological Society, Inc.

2. The purposes for which the corporation is to be formed are to promote the scientific study of aging, in order to advance public health and mental hygiene, the science and art of medicine, and the cure of disease: to foster the growth and diffusion of knowledge relating to problems of aging and of the sciences contributing to an understanding thereof; to afford a common meeting ground for representation of the various scientific fields interested in such problems and those responsible for care and treatment of the aged; all without profit to the corporation or its members.

3. The corporation will operate principally in the United States of America, but may carry on its operations anywhere throughout the world.

4. The principal office of the corporation is to be located in the Borough of Manhattan and in the City, County and State of New York.

5. The number of its directors shall be not less than five and not more than twenty.

6. The names and residences of the directors until the first annual meeting shall be:

Dr. Earl T. Engle, College of Physicians and Surgeons, 630 West 168th Street, New York

Mr. Lawrence K. Frank, 72 Perry Street, New York City

Dr. Jean Oliver, Long Island College of Medicine, 335 Henry Street, Brooklyn, New York

Dr. Oscar Riddle, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, New York

Dr. Henry S. Simms, Columbia University, College of Physicians & Surgeons, 630 West 168th Street, New York

7. All of the subscribers to this certificate are of full age. At least two-thirds of them are citizens of the United States. At least one of them is a resident of the State of New York. Of the persons named as directors, at least one is a citizen of the United

States and a resident of the State of New York.

8. No director, council member, member, officer or employee of the corporation shall receive any pecuniary profit from the operations thereof other than reasonable compensation for services rendered, reimbursement of expenses incurred in its service, or benefits received as a proper beneficiary of its strictly scientific and charitable purposes; nor shall any director, council member, member, officer or employee at any time have any personal interest in any property or assets of the corporation; nor shall any director, council member, member, officer or employee, in the absence of fraud or bad faith, be personally liable for the debts, obligations or liabilities of the corporation.

9. The persons mentioned in section 6 of this certificate of corporation, or a majority of them, shall hold a meeting and organize the corporation and adopt a constitution and by-laws not inconsistent with the Constitution and laws of this State.

10. For the accomplishment of any of its purposes the corporation hereby formed shall also have power to acquire property by grant, gift, purchase, lease, bequest or device and without limitation as to character, amount or value, except such limitation, if any, as the legislature shall impose; and to hold and dispose of the same to invest, reinvest, deal with and expend the property of the corporation in such manner as the trustees shall deem best.

11. No part of the activities of the corporation shall be attempted influence of legislation by propaganda or otherwise.

IN WITNESS WHEREOF, we have made, subscribed and acknowledged this certificate this 18th day of May, 1945.

(Signed by)

EARL T. ENGLE	L.S.
LAWRENCE K. FRANK	L.S.
JEAN OLIVER	L.S.
OSCAR RIDDLE	L.S.
HENRY S. SIMMS	L.S.

WAIVER OF NOTICE AND CALL FOR FIRST MEETING

The undersigned, constituting all of the incorporating members mentioned in the Certificate of Incorporation of Gerontological Society, Inc., hereby waive any and all notices of the first meeting of the said Corporation and call a first meeting to be held at 1 P.M. on the 15th day of June, 1945, at the Town Hall Club, 123 W. 43rd Street, New York City, New York, and authorize the transaction thereat of all business relating to the organization of the corporation, adoption of constitution and by-laws, election of new members to be associated with the members named in the said Certificate of Incorporation, and any and all other business which may properly be brought before such meeting.

Dated	*Signed by*
June 15, 1945	OSCAR RIDDLE
June 15, 1945	HENRY S. SIMMS
June 15, 1945	EARL T. ENGLE
June 15, 1945	L. K. FRANK
June 15, 1945	JEAN OLIVER

Minutes of First Meeting of Gerontological Society, Inc.

Pursuant to a written Waiver of Notice and Call, signed by the incorporators the first meeting of Gerontological Society, Inc. was held on the 15th day of June, 1945 at 1 P.M. at the Town Hall Club at 123 West Forty-third Street, New York, N. Y.

Mr. Frank was chosen Temporary Chairman and called the meeting to order.

Dr. Simms was appointed to act as Temporary Secretary of the meeting and directed to annex the Waiver of Notice and Call to the minutes.

The following incorporators were present:

DR. EARL T. ENGLE
MR. LAWRENCE K. FRANK
DR. OSCAR RIDDLE
DR. HENRY S. SIMMS

The following incorporator was absent:

DR. JEAN OLIVER

Also present was DR. ROBERT A. MOORE.

The Act of Incorporation of Gerontological Society, Inc. was read and the Temporary Secretary was directed to annex a copy to these minutes. A letter from and receipt for the filing fee for the Certificate of Incorporation of Gerontological Society, Inc. received from the State of New York, Department of State, Division of Corporations, were read and the Temporary Secretary of the meeting was directed to annex them to the minutes.

Draft copies of proposed by-laws of the corporation were read and, after due deliberation, upon motion duly made and carried, a set of By-laws was adopted and the Temporary Secretary was directed to annex a copy to these minutes.

In accordance with the provisions of the By-laws the membership of Gerontological Society, Inc. was expanded to include all of the members of the Club for Research on Ageing.

In accordance with the provisions of the By-laws the officers and members of the Executive Committee of the Club for Research on Ageing constituted the first Council. The Council is therefore comprised of:

WILLIAM DEB. MACNIDER (Chairman)
E. V. COWDRY
A. BAIRD HASTINGS
ROBERT A. MOORE
HENRY S. SIMMS
EDWARD J. STIEGLITZ

The Temporary Chairman called for nominations of officers of the corporation to hold office until the close of the first annual meeting in 1946, and the following officers were unanimously elected by ballot and assumed their respective duties:

For President: WILLIAM DEB. MACNIDER
For President Elect: (none elected)
For Treasurer: ROBERT A. MOORE
For Secretary: EDWARD J. STIEGLITZ

Upon motion duly made, seconded, and carried, it was voted that the society would have no dues during the year 1945.

There being no further business, upon motion duly made, seconded, and carried, the meeting was adjourned.

HENRY S. SIMMS
Secretary of the Meeting

Membership in the Gerontological Society, Inc.

The by-laws of the Society will be published in an early number of the Journal. Provision is made for several classes of membership:

1. Honorary—A person who has rendered distinguished service to the science of gerontology may be elected by the Council as an honorary member.
2. Sustaining—A person interested in but not actively engaged in the practice of gerontology may apply for membership and may be elected a sustaining member.
3. Senior—An active member of the Society who has reached the age of 65 years may, on application and by vote of the Council, be designated a senior member of the Society.
4. Active—A person actively engaged in any aspect of gerontology may apply for membership and may be elected an active member in one of 3 categories: medical, biologic, or general.

A Committee on Membership is empowered to pass on applications. The Council elects members. The section to which active members are designated is determined by the Committee at the time of election.

The Chairman of the Committee on Membership for the year 1946 is EARL T. ENGLE.

All correspondence should be directed and applications sent to Dr. Henry Simms, Columbia University, College of Physicians and Surgeons, 630 W. 168th St., New York, New York.

DUES FOR 1946

At a meeting of the Council on November 14, 1945, in New York, New York, dues for the year 1946 were determined as follows:

Honorary—waived unless the Journal is desired, then $6.

Sustaining—$25 including a subscription to the Journal.

Senior—waived unless the Journal is desired, then $6.

Active—$10 including subscription to the Journal.

The dues are payable on January 1, 1946, and remittances should be sent to Dr. Robert A. Moore, 507 S. Euclid, St. Louis 10, Missouri.

REGENERATION OF THE LIVER

The functions of the liver are both numerous and complex. A technique which makes possible a more exact analysis of changes in hepatic function in relation to aging is therefore of more than casual interest to the gerontologist. Through the experiments of Fishback (Arch. Path. 7: 955, 1929), of Higgins and Anderson (Arch. Path. 12: 186, 1931) and of Brues, Drury and Brues (Arch. Path. 22: 658, 1936) it has become established that the liver has a marked capacity to regenerate rapidly after partial hepatectomy. Cameron and Karunaratne (J. Path. and Bact. 42: 1, 1936) have shown that rapid regeneration of hepatic cells also occurs after necrosis produced by the administration of sublethal amounts of carbon tetrachloride. The capacity of the liver to restore itself after partial destruction is presumably one of the mechanisms by which the liver is able to maintain its functions under conditions which lead to destruction of its cells, and studies have been conducted to determine whether or not this capacity is changed with advancing age. Norris, Blanchard, and Povolny (Arch. Path. 34: 208, 1942) concluded on the basis of weight of residual liver at different periods after partial hepatectomy that the rate of regeneration of rat liver varies inversely with the age of the animal. Marshak and Bryon, (Proc. Soc. Exper. Biol. & Med. 59: 200–202, 1945) reached a similar conclusion based upon a study of mitotic activity in regenerating livers of young and old rats. The peak of mitotic activity occurred earlier in the younger animals.

Brues and Marble (J. Exp. Med. 65: 15, 1937) conducted an analysis of mitosis in hepatic restoration by the laborious and time-consuming method of counting mitotic figures in stained sections of regenerating liver. A refinement of this method was devised by Marshak (J. Gen. Physiol. 25: 275, 1941) which consisted of a technique for obtaining free hepatic nuclei. The liver was treated with cold 5 per cent citric acid, minced, ground in a mortar and centrifugalized. The sediment separated into several layers, the lowest being the nuclei. The upper layers were removed and the layer containing the nuclei was purified by repeated washing. The nuclei were resuspended, brought to a fixed volume, and the mitosis rate was determined by counts of the nuclear suspension in a hemocytometer. For simplicity, only nuclei in metaphase and anaphase were classified as being in mitosis. As pointed out by Marshak and

The figure of the man at the right top of this page is a copy of the drawing of the Greek God, Geras, on a pelice in the Louvre depicting Heracles and Geras.

Bryon, this method of assay made it possible to test the effects of as many as 10 factors on liver regeneration within a week. In addition to the effect of age upon the rate of mitosis in regenerating liver, the authors concurrently studied the uptake of labelled phosphorus (P^{32} as Na_2HPO_4) by regenerating liver in rats of different ages. Doses not exceeding 1.5 μc of P^{32}/gm. of body weight were injected 3 hours before removal of the liver for assay.

It was found that the peak of mitotic activity in regenerating livers of rats 1, 5, and 16 months old occurred on the first, second, and third postoperative days, respectively. The uptake of P^{32}, as measured with a Geiger-Muller counter, was at a maximum at 0, 1, and 2 days for the same age groups. Maximum uptake of P^{32} thus anticipated mitotic activity by one day. In animals 1 month old there was at all postoperative periods a greater uptake of P^{32} than in animals of the older age groups. Although the authors do not comment, it is possible that the higher uptake of P^{32} may be related to the generally higher metabolic rates of liver of very young rats shown by Hawkins (J. Gen. Physiol. 11: 645, 1928) and by Norris, Blanchard and Povolny.

Marshak and Walker (Am. J. Physiol. 143: 226, 1945) have extended the investigations described using regenerating liver as a method of assay to determine the effects of injection of various liver fractions on mitotic activity. In preliminary tests the authors found that nuclei in mitosis were evenly distributed throughout the nuclear layer of their centrifuged samples, and that radioactive phosphorus in the amounts administered produced no significant effect on mitosis. It was concluded from investigations of various liver fractions that "mitosis in regenerating liver is increased by intravenous injections of small amounts of chromatin, fat free chromatin, and that portion of chromatin which is soluble in 1 M NaCl. Mitosis is inhibited by other fractions from liver and by that portion of chromatin which is insoluble in 1 M NaCl. Amino acids, nucleic acid, lipid, biotin, adenosine triphosphate and insulin have either no effect or an inhibitory one on mitosis. Chromatin contains some factor which stimulates mitosis." In a further studyM arshak and Walker (Am. J. Physiol. 143: 235, 1945) showed that P^{32} in liver chromatin is incorporated more readily into the nuclei of regenerating hepatic cells than is P^{32} as inorganic phosphate. This would indicate that the chromatin fraction which increases mitosis becomes incorporated into the hepatic nuclei. Extracellular nucleoprotein might thus become built into the nucleus by means of this mechanism of physiological exchange. Such a possibility would have an important bearing upon cellular physiology and genetics in that a substitution of chromosomal protein might lead to a change in function comparable to a gene mutation.

The significance of the experiments of Marshak and associates in relation to gerontology may be in several directions. In view of the decreasing capacity of hepatic tissue to regenerate with advancing age, comparable injury to the liver would be more serious in the aged than in the young because recovery might be prolonged. MacNider (Problems of Aging, 2nd. ed., p. 664, Williams and Wilkins, Baltimore, 1942) has shown that with advancing age, the liver becomes more resistant to certain types of injury. This change in resistance may be an expression of a decreasing capacity of the liver to absorb injurious substances in carrying out its function of detoxication. Injurious or active substances may thus produce significant effects on other tissues in advanced age because they are not so readily removed or altered by the liver. Particular attention should, therefore, be given to the functional state of the liver in the aged. The technique developed by Marshak and associates affords a means of studying factors which may be concerned in hepatic regeneration. It might be supposed that the rate of regeneration is a sensitive index of the functional condition of the liver. Substances which exert effects either favorable or un-

favorable but so slight as to be unrecognized in the usual histologic examination may perhaps be evaluated by the technique of Marshak, and the results of such evaluation applied to the clinical aspects of gerontology.

JOHN A. SAXTON, JR.

SIZE OF THE PALATINE TONSILS

Exact information on the involution and atrophy of the palatine tonsils, organs which can be observed very easily throughout life, is still not available. A concept of a "normal" palatine tonsil is made difficult because the size of the tonsil is influenced by so many variable factors. The literature on the subject has, to no small extent, increased this state of confusion.

G. S. Hett, and H. G. Butterfield, (The Anatomy of the Palatine Tonsil, J. Anat. & Physiol., London 44: 35, 1909–10) stated that atrophy of the deeper parts of the tonsillar structure began as early as the fifth year of life. Others believe that the tonsils are largest during childhood, and that the involution of age begins at or shortly following puberty (Hett, G. S., The Anatomy and Comparative Anatomy of the Palatine Tonsil & Its Role in the Economy of Man, Brit. Med. J. 2: 743, 1913; Dietrich, A., Rachen and Tonsillen In Henke-Lubarsch Handb. d. Spez. Path. Anat. u. Hist. 4: 1–75, 1926; Hellman, T., Der lymphatische Rachenring. Moellendorf's Handb. d. mikrosk Anat. 5: 245–289, 1927; and Schonberger, M., Die grosse der Gaumentonsillen im Kindesalter. Ztschr., f. Kinderheilk 39: 367–371, 1929). Mathies (Ueber die Entwicklung des Waldeyerschen Rachenrings, Beitr. z. path. Anat. u. z. Allg. Path. 94: 389–403, 1935) observed that there is marked development after the age of puberty, and Kniatchetsky stated that the tonsils are three and one half times as large at 20 years of age as they are at 5 years. Hieronemus (Warner, Die Grösse der Gaumentonsillen in den verschiedenen Lebensaltern, Rostock, Dissertation, 1933) on the basis of a study of autopsies concluded that the palatine tonsils reach maximum size at about 12 years of age, remain stationary until involution begins at about 35 to 40 years, and finally start to atrophy in the sixth decade.

The recent observations of Keleman G. (Clinical Observations on the Palatine Tonsil in the Aged. Ann. Otol., Rhin. & Laryng. Vol. LIV; 421–435, 1945.) are based upon a clinical study of 309 patients —50 men and 50 women in each of the seventh, eighth, and ninth decades, plus 9 additional patients between the ages of 90 and 103 years. It is apparent from this study that the size of the palatine tonsils shows a steady decrease as age advances. The most rapid decline occurs in the ninth decade where 25 empty fossae were observed; a condition rarely encountered before this age. Tonsils protruding beyond the arches and filling the fossae were observed in 57, 55, and 25 patients in the seventh, eighth, and ninth decades respectively. It is clear that the palatine tonsils do not completely involute in middle life as is so frequently stated. The rate of decrease in size is not spectacular until after 80 years of age.

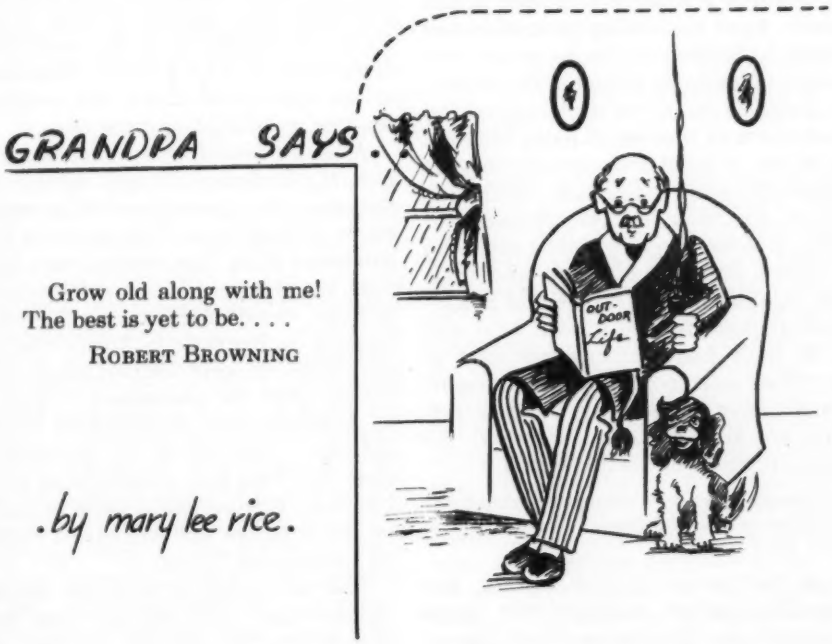
At higher ages there is a tendency for the tonsils to retract from the superior pole with the formation of vertical ridges of tonsillar tissue along the deep longitudinal axis of the fossa. Thus, the tonsil forms a "drop-like" configuration leaving the upper pole clean and extending into and below the lower pole. Occasionally a small crater surrounds the last cryptal opening.

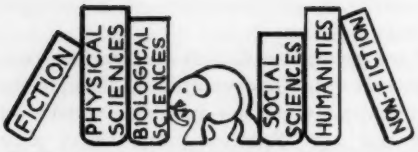
Changes in the surface indicative of involution are flat plaques and web-like linings of the bottom of the fossa as well as opening and eversion of the cryptal orifices. There is no particular change in color. The tonsillar fossa itself is seemingly untouched in the involutionary changes when previous tonsillectomy has not been performed. Atrophy and scarring of the

pillars are noted in tonsillectomized patients even when this operation was performed late in life. Cyst formations in the tonsillar remnants or fossae, which so often have been cited as indicative of degeneration, is not a characteristic involutionary change. It was noted in only 5.1 per cent of the patients. The signs of acute infectious processes involving the tonsils in this age group, even though only a very small remnant remains, are the same as in younger patients.

These extensive clinical observations are of distinct value in crystallizing thought on what happens to the palatine tonsils in advanced age. Further information may be gained, as indicated by Keleman, by correlation of observations by the three methods of study: clinical, operative specimens, and material obtained at autopsy.

WAYNE P. SIRLES





BOOKS

MEDICINE AND DRAMA

THE HUMORS AND SHAKESPEARE'S CHARACTERS, John W. Draper, Duke University Press, Durham, North Carolina, 1945. $2.00.

The brilliant Elizabethan period and one of its by-products, the Shakespearean plays, might be compared to a piece of fine old silver. Each succeeding generation has deposited a thin film of change, a variation of society, language or thought. The scholar must burnish the silver and restore the original lustre so that we of today may see through the eyes of the commonality of Seventeenth century England. With this viewpoint Professor Draper, professor of English at West Virginia University, who has written over sixty papers about his subject, approaches the problem of Shakespeare's attitude toward human kind and how he built his character-creations in terms of the contemporary medical thought. He would have us ask why Hamlet, during his assumed madness, answered the troubled inquiries of his mother with

> My pulse, as yours, doth temperately keep time
> And makes as healthful music; it is not madness
> That I have utter'd.

To us this means little or nothing, but to the Elizabethan audience the words were proof that Hamlet was not insane. Why? Because there was a medical aphorism, derived from Galen's De Pulsebus, that an irregular pulse was a sigh of lunacy. It is known that Shakespeare was familiar with some of the works of Galen in as much as he referred to him by name at least once.

For many centuries before and for a few centuries after Shakespeare, thought on the nature and cause of disease revolved about the four humors—blood, phlegm, white bile, and black bile. In fact, a preponderance of one of the humors determined the character and reactions of the person. The humors thus conferred types: Respectively sanguine, phlegmatic, choleric, and melancholy. In turn each humor and type was associated with a certain planet, constellation of the zodiac, hours, days, seasons, colors, metals, diseases, time of life, special situations and events, professions, vocations, and the like.

After an introductory chapter of background, Professor Draper systematically discusses the characters of Shakespeare in terms of their type: The sanguine lover is handsome King Navarre in *Love's Labour's Lost;* the phlegmatic man, soft and sluggish of body, timid of spirit, and dull of mind appears as Benvolio in *Romeo and Juliet;* the varied choleric temperaments clash in *Othello;* and the melancholy type is used to represent the disappointed lover and old man. Then, as on all occasions when mere man sets up a classification, some are left over. Draper treats these in a chapter on the Balanced and Mercureal Types and on Counterfeit Types.

The melancholy type is the opposite of the sanguine—cold and dry—and hence is appropriate for old age. At the time of Shakespeare there was general agreement on the physical characters of the melancholy man. Lemnius described "body ill favored, leane, dry, lank, pylde skinned and wythout hair,—brooked—worne wyth sicknes and old age." In Draper's opinion this depiction of old age appears in *King Lear,* in York in *Richard II,* in Hamlet's lean beggar, in Jaques's "lean and slipper'd pantaloon" who needed spectacles and

spoke in "childish treble"; and in the "lean Cheek" that Rosalind noted as the indispensable mark of love melancholy. [An article by Professor Draper on this aspect of the subject appears in this issue.]

The theme of the book may be summarized in two quotations: "A modern novelist in his characters may depict the operation of heredity or environment; but the operation of these forces does not necessarily preclude their own freedom of decision, for men can change environment and sometimes circumvent heredity; and Shakespeare's figures, likewise, are portrayed, not the mere slaves, like Jonson's, of their humor, but struggling or succumbing as men do in actual life—as masters or as servants of their tendencies innate at birth or acquired by profession, age, or situation among their fellows. Thus, within the complex pattern of the humors, the dramatist shows the impress on human character of social environment and (if not of heredity) at least of those astrological accidents of birth that somewhat took its place in Renaissance belief."

"The past, therefore, should be explored down more than one converging road; and, though medicine and drama may at first glance seem unrelated, the need of the latter for psychological expression forges a major link; and thus contemporary medicine is one vista through which Shakespeare's characters can, and should, be viewed; for it is the way that the Elizabethans themselves viewed his vivid and complex creations."

ROBERT A. MOORE

CARE AT THE END OF LIFE

THE CARE OF THE AGED, THE DYING, AND THE DEAD by Alfred Worcester, Charles C Thomas, Springfield, Illinois, 1945, $1.50.

This small book appearing new as the second printing of the second edition, is divided in accordance with the title into three chapters—care of the aged, care of the dying, and care of the dead. Each is a lecture at the level of the medical student and young physician. The emphasis is on the art of medicine rather than the science of medicine as exemplified in one quotation "In the practice of our art it often matters little what medicine is given, but matters much that we give ourselves with our pills."

The author, a student under Oliver Wendell Holmes, was long professor of hygiene at Harvard University. Each of the three chapters was originally presented as a lecture and published in medical journals.

In care of the aged moderation and individualization are emphasized. There is little new in detail, but the viewpoint of the family physician as friend and counsellor is well presented. "In normal senescence labor naturally becomes less fruitful, but life, while lacking the ecstasies of springtime, yet has in it the peaceful warmth of autumn; and nearer its normal end, it should be expected not to have the winter of discontent, but rather the lovely haze of Indian summer. To guard and promote such normal senescence, I hold to be one of the physician's greatest privileges."

Included in the chapter on care of the dying there are descriptions of the signs of impending death, a discussion of the pros and cons of whether or not there is a physical and/or an emotional agony of death, and an interesting consideration of when and how the patient and the family are to be informed of the approaching event. "Devotion to the truth does not require the physician to voice his fears or tell his patient all he thinks he knows."

The last chapter—care of the dead—is a polemic on modern burial methods in America. Expenditures for elaborate funerals and caskets are denounced, and fear is expressed that before long too much productive land will be converted into cemeteries.

ROBERT A. MOORE

A FORMULA FOR LONGEVITY

THE SECRET OF A LONG AND ACTIVE LIFE, by Frank Linden, privately published, 1943, $1.00.

Many older people have a personal formula, prescription, or set of rules which in their sincere or commercial belief is the basis for a long life. Some go to the lecture platform, others organize companies to sell the idea or necessary apparatus, and still others publish small or large books. Mr. Linden, whose real name is Frank Linden Andrews, an investment-banker and an apparent lover of horses, has chosen to record his rules entitled "The Lesser Ten Commandments" in a small book of sixty-four pages, endorsed by the Better Life Foundation of Fall River, Massachusetts. Mr. Linden has also written "A Layman's Creed" and is now preparing a series of articles to be published in book form on "A Layman's Views" giving his reflections on Faith, Prayer, and Evil.

Few physicians will quarrel with the ten lesser commandments—give thyself fresh air, keep thy mind and body active, give thyself good food, give thyself sufficient sleep and rest, keep thyself clean inside and out, give thy lungs full play, work and play, practice self-control, take regular health check-ups, "think on these things." All the commandments are to be taken in moderation.

Many physicians will have serious question about the strict scientific accuracy of some of the side remarks: that exercise from rings suspended in a doorway may increase the height up to one-half inch; that when we bend and stretch, we constrict our cells and help to shed the dry tissues; that it is "agreed by outstanding medical authorities and specialists that habitual smoking shortens life appreciably and that it is more harmful to females"; that the dog has constipation because he is man's responsibility; and that bacteria in the colon through the eating of meat are one of the major causes of old age.

Yet there are many words of old New England common sense: "We must keep open minds, science above all"; "Man has apparently conquered pretty much everything he has tackled except himself, on whom he has done a rather poor job to date"; "Have a hobby"; and "Work is a panacea for many if not most of the ills which flesh is heir to."

In summary, this book is one of the personal formulas for living to a ripe old age. It was successful for one man, but will not necessarily help others. There are multiple factors, such as heredity, constitution, environment, and many others still unknown which control longevity.

ROBERT A. MOORE

PERSONAL REFLECTIONS

A SURGEON LOOKS AT LIFE, by Richard A. Leonardo, Froben Press, New York, 1945, $2.00.

It is a well recognized prerogative of those who have attained mature years to use the printed word to record for posterity their experiences, adventures, and philosophies. Dr. Leonardo began before 1942 to do just this and thus is following his own advice: "After the problems of education, a career, marriage, and a family have been met, the individual's interest and energy are freed from personal problems to be turned toward those of his community and society." So far there have come from his pen five books, *American Surgeon Abroad*, *History of Surgery*, *History of Gynecology*, *A Doctor's Advice to Women*, and *A Surgeon Looks at Life*, and there are four more in preparation. Dr. Leonardo was formerly city coroner for the City of New York and has spent a good deal of time traveling abroad.

In this latest addition to the series, *A*

Surgeon Looks at Life, there are tidbits of information on the history of Christian Science, on the controversy over the Freudian theories of infantile sexuality, and on the use of the cornea from dead persons to alleviate blindness. Many larger problems such as euthanasia, juvenile delinquency, contraception, and abortion are dealt with. But the gaze of the surgeon looking at life penetrates even beyond things material and comes to rest on broad philosophies of "What am I," "What is the world," and "Life after death." The summary of the surgeon is "If each individual does his utmost in this life to live up to his beliefs, alleviate suffering, to further research in his own field, contribute to civic improvement, and leave his family financially protected, what more can he hope to achieve?"

Even if the reader does not agree with the reasoning and conclusions, he will find realistic and frank treatment of the subject. For example, the social and religious aspects of birth control, abortion, and sterilization are met head-on. A few quotations will suffice to illustrate: "Psychological causes of abortion cannot be legislated out of existence—," "The mother's life is worth more than the child's—," "Legislators can pass laws, but only public opinion can enforce them."

In general attitude, the author accepts benevolent paternalism of government but still holds tightly to freedom. In discussion of juvenile delinquency he says, "These facts prove beyond question of doubt that a totalitarian regime is a more effective machine, but what we in America have to decide is whether or not we wish this solution of our problem. Are we willing to eradicate juvenile delinquency at the cost of freedom? Or have we the moral fibre and determination necessary to regain family control of our youth—?"

The chapter on "Gerontology and Geriatrics" is a synopsis in nine pages of all areas of these subjects. A phrase, sentence, or paragraph touches on population trends, nature of the aging process, diagnosis of disease in the aged, value of periodic health examinations, rejuvenation and sex hormones, emotional life of the elderly, the clash of generations, and the economic and social place of the older generation. There are no new ideas or viewpoints but in general, sane treatment of those known before. In consideration of the clash of old and young, there is the usual bluntness—"An otherwise harmonious home should not be disrupted because of false sentimentality toward either party—and the welfare of the children should be considered of paramount importance." Somewhat different is the concluding paragraph of this chapter: "All changes due to age are not deteriorations; on the contrary, age may bring greater wisdom, maturity, experience, mellowness, and tolerance. Could we face a world in which everyone over the age of fifty had been eliminated? I doubt it."

ROBERT A. MOORE

HIGH TIME, by Mary Lasswell, Houghton Mifflin Company, Boston, 1944, $2.00.

When three women of questionable age start out to do something about the war effort, things happen. Unfortunately, Mrs. Feeley, Miss Tinkham, and Mrs. Rasmussen of *High Time* find they are a bit too antiquated for war plants, although Miss Tinkham strongly asserts that "mere callow youth is not always sufficient equipment to cope with emergencies such as may arise in total war. It seems that ladies of more mature experience and riper philosophy would be better equipped." Such a typical remark of advancing years!

And so their war efforts consist of caring for a pair of lusty-lunged twins appropriately named Franklin and Winston, so that their mother can keep her job in a war plant. These twins give the author a brilliant opening to take a stab at the child psychologists, which she very well does.

Besides this small scale day nursery, the ladies undertake a Travelers' Aid, a Dorothy Dix, and a Mr. Anthony service. Then there is a boarding table for six war workers whose hemoglobin is a little low due to the poor food restaurants have to offer these days. Their entire services are liberally interrupted during each day for the ladies' relaxing bottles of beer. As Mrs. Feeley put it, "Beer pads the ends o' the nerves with little fat cushions."

In between non-serious conversation there is occasionally a philosophical comment which clearly reflects the age of the ladies. Miss Tinkham, horrified, exclaims, "I, for one, have never associated with old people and I have no intention of beginning now!" Attempting to eat salted peanuts, Mrs. Feeley grins and says, "I ain't got no teeth, but I can sure gum hell out of 'em."

Then there is Miss Tinkham's glamorous outfit, obviously saved from some previous age and brought out only on gala occasions. The skirt was a good sixteen inches longer than the current fashion, but "everyone knew how knitted fabrics raveled when cut, and besides the material was so handsome." The sweater top was a dazzling affair embroidered in sequins and crystal beads.— The final touch, the coup de grace of a handsome picture hat made of accordion-pleated Kelly green lace with a shallow crown and a wide, oval brim, completed her costume.

The author, Mary Lasswell, has added *High Time* as a sequel to her first book, *Suds in Your Eye*, in which she introduces the three old ladies and starts them on their merry adventures.

PEGGY BRONSON

MENTAL GERIATRICS

MENTAL DISORDERS IN LATER LIFE, Oscar J. Kaplan, Stanford University Press, Stanford University, California, Humphrey Milford: Oxford University Press, London, 1945, $5.00.

A striking parallel between the development of child psychiatry and mental geriatrics is evident. It has been only a few decades since textbooks of psychiatry, when discussing child psychiatry, confined themselves to extreme cases which required nothing but custodial care; all we learned about them were outspoken cases of amentia. In the meantime a vast borderline has been opened. Maladjustment, neuroses in childhood, distorted parent-child relation, many problems which occur within the physiological range of development form the main subject of child clinics today, and these classical textbook conditions have lost their relative importance.

The last few years indicate a similar trend in mental geriatrics. "Mental Disorders in Later Life" is the first significant token of this development. The book is edited by Oscar J. Kaplan, professor of psychology, University of Idaho, and consists of chapters written by sixteen authors. It is impossible to discuss this book in detail; the best way to give an idea of its scope is to enumerate the chapter headings: "Introduction" (Karl M. Bowman); "A Statistical Review of Mental Disorders in Later Life" (Horatio M. Pollock); "Physiological Aspects of Mental Disorders in Later Life" (Nathan W. Shock); "Psychological Aspects of Mental Disorders in Later Life" (Harold E. Jones and Oscar J. Kaplan); "Sociological Aspects of Mental Disorders in Later Life" (H. Warren Dunham); "Mental Health and Nutrition in Old Age" (L. Erwin Wexberg); "Neuroses of Later Maturity" (Norman Cameron); "The Involutional Psychoses" (Eugene Davidoff); "The Presenile Dementias" (George A. Jervis); "Senile Psychoses and Psychoses with Cerebral Arteriosclerosis" (David Rothschild); "The Toxic Delirious Reactions of Old Age" (G. Wilse Robinson, Jr.); "Older Mental Patients after Long Hospitalization" (Eugenia Hanfmann); "The Aged Subnormal" (Oscar J. Kaplan); "Psychosomatic Medicine and the Older Patient" (Bela Mittelmann); "Psycho-

therapy in the Older Individual" (Fred V. Rockwell); "Mental Hygiene in Later Maturity" (Nolan D. C. Lewis); and "Orientation of the Problems" (Edward J. Stieglitz).

It is amazing to see the amount of factual material accumulated since those not so distant days when "involution and senescence" evoked in psychiatrists only one single association—"asylum." Hence the most impressive pages are those which deal with psychotherapeutic, sociological, psychoanalytical, and psychosomatic avenues to the problem, with neuroses in the higher age group and with psychological and physiological aspects of old age disorders. Frequently in books of this type the reader receives a definite impression of the editor's own leanings, whether they are somatic or psychological. This is carefully avoided here, and the editor has succeeded in balancing diverse elements against one another. Over-lapping has been avoided as much as possible, not only of various chapters with one another but also of the whole book with general handbooks of gerontology (such as Cowdry's). This is the possible reason why in places the style of the book is too compact and terse so that it seems to consist of an enumeration of references, and some chapters appear altogether too short, e.g., the one on "Mental Health and Nutrition in Old Age." The same is true with regard to certain neurological aspects of old age, for instance, senile Parkinsonism and other extrapyramidal disturbances which have certain psychiatric implications. Some overlapping on these subjects with general geriatric manuals would not have done any harm. Shock's otherwise excellent chapter on physiology might benefit from an enlargement on certain topics, e.g., physiology of steroid hormones during involution.

Apart from these minor details there is no doubt that this first comprehensive book on mental geriatrics has a good chance to remain the standard work on the subject.

KARL STERN

The reason so many retired men die mentally is because they stop doing everything they do not want to do. When they do that they also stop growing. Growth is a result of assuming obligations and responsibilities. Retirement is too often a state of slow decay and death. The minds of too many retired men become stagnant pools.

THOMAS DREIER

A prescription for old age: A judicious choice of parents, avoidance of disease and worry, moderation in all things, mental and physical exercise, and open-air life, serenity, and charity to all men.

SIR HUMPHREY ROLLISTON

BOOKS RECEIVED

Books received since July 1, 1945, are acknowledged in the following list. Insofar as space and time permit, some will be selected for review in a later issue, but it is unlikely that all will be reviewed.

A Surgeon Looks at Life, by Richard Leonardo, Froben Press, New York, 1945, $2.00, 128 pages. (Reviewed in this issue, page 144)

The Humors and Shakespeare's Characters, by John W. Draper, Duke University Press, Durham, North Carolina, 1945, $2.00, 126 pages. (Reviewed in this issue, page 142)

The Care of the Aged, The Dying and the Dead, by Alfred Worcester, Charles C Thomas, Springfield, Illinois, 1945, $1.50, 77 pages. (Reviewed in this issue, page 143)

The Secret of a Long and Active Life, by Frank Linden, Privately published, 1943, $1.00, 64 pages. (Reviewed in this issue, page 144)

The Role of the Aged in Primitive Society, by Leo W. Simmons, Yale University Press, New Haven, Connecticut, 1945, $4.00, 317 pages. (An article by Dr. Simmons on the same subject appears on page 72 of this issue)

Old Age, Some Practical Points in Geriatrics, by Trevor H. Howell, H. K. Lewis & Co., London, 1944, 4s6d, 50 pages.

Cass Timberlane, by Sinclair Lewis, Random House, New York, 1945, $2.75, 390 pages.

Biological Symposia Volume XI, edited by Jaques Cattell, The Jaques Cattell Press, Lancaster, Pennsylvania, 1945, $3.00, 242 pages.

Trauma in Internal Diseases, by Rudolf A. Stern, Grune and Stratton, New York, 1945, $6.75, 575 pages.

Old Age in New York City, by Helen Hardy Brunot, Welfare Council of New York City, 1943, $1.50, 125 pages.

Physical Chemistry of Cells and Tissues, by Rudolf Hober, The Blakiston Company, Philadelphia, 1945, $9.00, 676 pages.

New Goals for Old Age, by George Lawton, Columbia University Press, New York, 1944, $2.75, 210 pages.

Mental Disorders in Later Life, by Oscar J. Kaplan, Stanford University Press, Stanford University, California; Humphrey Milford: Oxford University Press, London, 1945, $5.00, 436 pages. (Reviewed in this issue, page 146).

GERONTIUS RESARTUS

Gerontius pertains to man well past the age of dancing.
Enfeeblement that comes with age will, like toxins, stimulate
Recruits in Geriatric Art to keep men young much longer.
On age alone, no one need be less perfect than Apollo,
Nor will they see that wrecks of time may not be strong as Samson.
Time brings no sad, no bad effect that they cannot well direct
Into the fields Elysian, where the good gerontii
Unhampered by the tides of life, are ever grateful to you.
Soon there they find old men may dream, and like the young see visions.

Revitalized Gerontos may live better than when younger.
Enlightened by experience he avoids the garish life;
Strong again despite youth's blunder, like Hippocrates he knows
Art is long, all life is short, and the ghost of Panacea
Resplendent lives in cure-all fads, that may cut life still shorter.
The cure for every fad is found in the art Hygeia built.
Until old age comes creeping on with many an ache and qualm, you
Surely may not need the balm well known in geriatrics.

H. A. McGuigan

INDEX TO CURRENT PERIODICAL LITERATURE

It is difficult to cover all journals and list all papers concerned with aging and the aged. Authors and publishers are requested to call attention to publications or send reprints.—Editor.

ALDERSTEIN, F. R.—Full Lives for the Aged. *Recreation*, 39: 464, 1945.

ANESTHESIA—Anesthesia in the Aged. E. H. Watts. *The Canadian Medical Association Journal*, 53: 20, 1945.

BARRY, HERBERT—Influence of Advanced Maternal Age in Mothers of One Thousand State Hospital Patients. *Archives of Neurology and Psychiatry*, 54: 186–191, 1945.

BEHAVIOR—Aggressive Behavior in the Rat: 1. General Characteristics; Age, Sex Differences. John Seward. *Journal of Comparative Psychology*, 38: 175–197, 1945.

BENNETT, HELEN C.—Your Occupation Determines Your Life Span. *Modern Digest*, 4–12: 16–18, 1945.

BERGER, G.—Human Problems of Old Age. *Recreation*, 39: 373, 1945.

BLUMENTHAL, HERMAN—Aging Process in the Endocrine Gland of the Guinea Pig. The Influence of Age, Sex and Pregnancy on the Mitotic Activity and Histologic Structure of the Thyroid, Parathyroid, and Adrenal Glands. *Archives of Psychology*, 40: 264–269, 1945.

BRYON, R. L., Jr.—(See Marshak, A. and R. L. Bryon, Jr.)

CAMARGO, OSWALDO—and George Preston. —What Happens to Patients Who are Hospitalized for the First Time When over 65 Years of Age. *American Journal of Psychiatry*, 102: 168–173, 1945.

CAMPBELL, H. L.—and Madeline Udiljak, Helen Yarmolinsky, H. C. Sherman. Bodily Storage of Vitamin A in Relation to Diet and Age, Studied by the Assay Method of Single Feedings. *Journal of Nutrition*, 30: 343–348, 1945.

CARE—Sheltered Care for the Aged. J. J. Griffin. *Survey Midmonthly*, 81: 323–326, 1945.

CARP, LOUIS—Surgery for the Aged. *Hygeia*, 23: 580–581, 1945.

CATCHPOLE, H. R.—(See Hamilton, J. B., H. R. Catchpole, and C. C. Hawke.)

CHIDECKEL, MAURICE—At the Sunset of Life: A Review of Gerontology and Geriatrics. *Medical Record*, 158: 665. 1945.

CICERO—The Blessings of Old Age. *Encore*, 8: 701, 1945.

COATES, ROBERT M.—The Art Galleries—A Couple of Oldsters. *New Yorker*. 21–45: 62–63, 1945.

DAWSON, PERCY—Influence of Aging on Power and Endurance in Man. *Research Quarterly*, 12: 95–101, 1945.

DUFFIELD, THOMAS—and Paul H. Jacobsen.—Cancer Mortality and Marital Status: An Analysis of Deaths Attributed to Cancer Among White Population of New York City during 1939. *Journal of National Cancer Institute*, 6: 103–112, 1945.

DUNN, HALBERT L.—Married People Live Longer. *Hygeia*, 23: 820, 1945.

DUSTIN, VIRGINIA—(See Myers, Arthur and Virginia Dustin)

ENDOCARDITIS—Subacute Bacterial Endocarditis in the Aged. F. D. Zeman. *American Heart Journal*, 29: 661–684, 1945.

ENDOCRINE—Aging Process in the Endocrine Gland of the Guinea Pig: 1. The Influence of Age, Sex, and Pregnancy on the Mitotic Activity and the Histologic Structure of the Thyroid, Parathyroid, and Adrenal Glands. Herman Blumenthal. *Archives of Pathology*, 40: 264–269, 1945.

ENGLE, E. T.—Youth Cannot Be Kept;

Aging Process. *Science News Letter*, 47: 356–357, 1945.

EUNUCHS—Titers of Gonadotrophins in Urine of Aged Eunuchs. J. B. Hamilton, H. R. Catchpole, and C. C. Hawke. *Journal of Clinical Endocrinology*, 5: 203–209, 1945.

FREEMAN, BEATRICE—Flattering Figures for Fortyish Femmes. *Magazine Digest*, 31: 108–111, 1945.

GELBAUM, SELMA—(See Wermel, Michael T. and Selma Gelbaum.)

GENERAL—A Biologist Reflects Upon Old Age. F. Sumner. *Scientific Monthly*, 61: 143–149, 1945.

The Art Galleries—A Couple of Oldsters. Robert M. Coates. *New Yorker*, 21–45: 62–63, 1945.

At the Sunset of Life: A Review of Gerontology and Geriatrics. Maurice Chideckel. *Medical Record*, 158: 665, 1945.

The Blessings of Old Age. Cicero. *Encore*, 8: 701, 1945.

Flattering Figures for Fortyish Femmes. Beatrice Freeman. *Magazine Digest*, 31: 108–111, 1945.

Full Lives for the Aged. F. R. Alderstein. *Recreation*, 39: 464, 1945.

Gerontology. H. W. Soper. *American Journal of Digestive Diseases and Nutrition*, 12: 219–221, 1945.

Mental Decline and Its Retardation. George Lawton. *Journal of General Psychology*, 32: 229, 1945.

Middle Life and Old Age. Jacob Smithline. *Medical Record*, 158: 407–411, 1945.

Recreation for Older People, J. J. Griffin. *Recreation*, 39: 289, 1945.

Richer Lives for the Elderly, G. R. Tueller. *Recreation*, 39: 260, 1945.

Tomorrow You May Be Younger. William L. Laurence. *Ladies Home Journal*, 62: 22, 1945.

Why We Grow Old, A. C. Ivy, *Hygeia*, 23: 420, 1945.

Youth Cannot Be Kept; Aging Process. E. T. Engle. *Science News Letter*, 47: 356–357, 1945.

GONADOTROPHINS—Titers of Gonadotrophins in Urine of Aged Eunuchs. J. B. Hamilton, H. R. Catchpole, and C. C. Hawke. *Journal of Clinical Endocrinology*, 5: 203–209, 1945.

GRIFFIN, J. J.—Recreation for Older People. *Recreation*, 39: 289, 1945.

Sheltered Care for the Aged. *Survey Midmonthly*, 81: 323–326, 1945.

HAMILTON, J. B.—and H. R. Catchpole and C. C. Hawke.—Titers of Gonadotrophins in Urine of Aged Eunuchs. *Journal of Clinical Endocrinology*, 5: 203–209, 1945.

HAWKE, C. C.—(See Hamilton, J. B., H. R. Catchpole, and C. C. Hawke.)

HEALTH—Foolish Fancies about Your Health. Peter J. Steincrohn. *Science Digest*, 18: 1–4, 1945.

Ten Tested Rules for Health. Mary Smart. *Pageant*, 1: 9–10, 1945.

HOLMAN, ROSS L.—Old Age and Industrial Efficiency. *American Mercury*, 61: 311–315, 1945.

HORVATH, STEVENS—The Distribution of Phosphorus Compounds in the Gastrocnemius Muscle as Influenced by the Aging Process. *American Journal of Physiology*, 145: 77–92, 1945.

HOSPITALIZED—What Happens to Patients Who Are Hospitalized for the First Time When over 65 Years of Age. Oswaldo Camargo and George Preston. *American Journal of Psychiatry*, 102: 168–173, 1945.

INDUSTRIAL—Old Age and Industrial Efficiency. Ross L. Holman. *American Mercury*, 61: 311–315, 1945.

IVY, A. C.—Why We Grow Old. *Hygeia*, 23: 420, 1945.

JACOBSEN, PAUL H.—(See Duffield, Thomas J. and Paul H. Jacobsen.)

JAMES, DAVID F. and R. Evans Lloyd. Splenectomy for Acquired Hemolytic Jaundice in the Aged. *New England Journal of Medicine*, 233: 143–148, 1945.

JAUNDICE—Splenectomy for Acquired Hemolytic Jaundice in the Aged. David F. James and R. Evans Lloyd. *New*

England Journal of Medicine, 233: 143–148, 1945.

LAWTON, GEORGE—Mental Decline and Its Retardation. *Journal of General Psychology*, 32: 229, 1945.

LAURENCE, WILLIAM L.—Tomorrow You May Be Younger. *Ladies Home Journal*, 62: 22, 1945.

LEHMEN, HARVEY C.—Intellectual versus Physical Peak Performance: The Age Factor. *Scientific Monthly*, 61: 127–137, 1945.

LIVER—The Use of Regenerating Liver as a Method of Assay. A Marshak and R. L. Byron, Jr. *Proceedings of the Society for Experimental Biology and Medicine*, 59: 200–202, 1945.

LLOYD, R. EVANS—(See James, David F. and R. Evans Lloyd.)

LONGEVITY—Influence of Aging on Power and Endurance in Man. Percy M. Dawson. *Research Quarterly*, 12: 95–101, 1945.

Study of 1400 Families in New York Showing Length of Life of Children and How it is Related to Survivorship of Parent. Sally Press. *Milbank Memorial Fund Quarterly*, 23: 180–196, 1945.

Toward a Longer Life. Arthur Myers and Virginia Dustin. *Hygeia*, 23: 338, 1945.

MARRIAGE—Married People Live Longer. Halbert L. Dunn. *Hygeia*, 23: 820, 1945.

Cancer Mortality and Marital Status: An Analysis of Deaths Attributed To Cancer Among White Population of New York City during 1939. Thomas J. Duffield and Paul H. Jacobsen. *Journal of National Cancer Institute*, 6: 103–112, 1945.

MARSHAK, A.—and R. L. Bryon, Jr. The Use of Regenerating Liver as a Method of Assay. *Proceedings of the Society for Experimental Biology and Medicine*, 59: 200–202, 1945.

MATERNAL—Influence of Advanced Maternal Age in Mothers of One Thousand State Hospital Patients. Herbert Barry. *Archives of Neurology and Psychiatry*, 54: 186–191, 1945.

MORTALITY—Cancer Mortality and Marital Status: An Analysis of Deaths Attributed to Cancer Among White Population of New York City during 1939. Thomas J. Duffield and Paul H. Jacobsen. *Journal of National Cancer Institute*, 6: 103–112, 1945.

MYERS, ARTHUR and Virginia Dustin. Toward a Longer Life. *Hygeia*, 23: 338, 1945.

NUTRITIONAL—Medical Evaluation of Nutritional Status: XVI. Essential Nutrients in Diets of High School Students According to Sex and Age and for Different Cultural Groups in New York City. Dorothy Wiehl and Katherine Barry. *Milbank Memorial Fund Quarterly*, 23: 353–385, 1945.

OCCUPATION—Your Occupation Determines Your Life Span. Helen C. Bennett. *Modern Digest*, 4–12: 16–18, 1945.

PERFORMANCE—Intellectual versus Physical Peak Performance: The Age Factor. Harvey C. Lehmen. *Scientific Monthly*, 61: 127–137, 1945.

PHOSPHORUS—The Distribution of Phosphorus Compounds in the Gastrocnemius Muscle as Influenced by the Aging Process. Steven Horvath. *American Journal of Physiology*, 145: 77–92, 1945.

PRESS SALLY—Study of 1400 Families in New York Showing Length of Life of Children and How it is Related to Survivorship of Parent. *Milbank Memorial Fund Quarterly*, 23: 180–196, 1945.

PRESTON, GEORGE—(See Camargo, Oswaldo and George Preston.)

PRIMITIVE—A Prospectus for Field Research in the Position and Treatment of the Aged in Primitive and Other Societies. Leo W. Simmons. *American Anthropologist*, 47: 433–438, 1945.

PROBLEMS—Human Problems of Old Age. G. Berger. *Recreation*, 39: 373, 1945.

RETIREMENT—Work and Retirement in

Old Age. Michael T. Wermel and Selma Gelbaum. *American Journal of Sociology*, 51: 16–21, 1945.

SENILITY, PREMATURE—Design for Fighting: Premature Senility. H. Shapley. *Atlantic Monthly*, 176: 110–111, 1945.

SEWARD, JOHN—Aggressive Behavior in the Rat: 1. General Characteristics; Age, Sex Differences. *Journal of Comparative Psychology*, 38: 175–197, 1945.

SHAPLEY, H.—Design for Fighting: Premature Senility. *Atlantic Monthly*, 176: 110–111, 1945.

SHERMAN, H. C.—(See Campbell, H. L., Madeline Udiljak, Helen Yarmolinsky, and H. C. Sherman.)

SIMMONS, LEO W.—A Prospectus for Field Research in the Position and Treatment of the Aged in Primitive and Other Societies. *American Anthropologist*, 47: 433–438, 1945.

SMART, MARY—Ten Tested Rules for Health. *Pageant*, 1: 9–10, 1945.

SMITHLINE, JACOB—Middle Life and Old Age. *Medical Record*, 158: 409–411, 1945.

SOPER, H. W.—Gerontology. *American Journal of Digestive Diseases and Nutrition*, 12: 219–221, 1945.

SPLENECTOMY—Splenectomy for Acquired Hemolytic Jaundice in the Aged. David F. James and R. Evans Lloyd. *New England Journal of Medicine*, 233: 143–148, 1945.

STEINCROHN, PETER J.—Foolish Fancies about Your Health. *Science Digest*, 18: 1–4, 1945.

SUMNER, F.—A Biologist Reflects upon Old Age and Death. *Scientific Monthly*, 61: 143–149, 1945.

SURGERY—Surgery for the Aged. Louis Carp. *Hygeia*, 23: 580–581, 1945.

TUELLER, G. R.—Richer Lives for the Elderly. *Recreation*, 39: 260, 1945.

UDILJAK, MADELINE—(See Campbell, H. L., Madeline Udiljak, Helen Yarmolinsky, and H. C. Sherman.)

VITAMIN—Bodily Storage of Vitamin A in Relation to Diet and Age, Studied by the Assay Method of Single Feedings. H. L. Campbell, Madeline Udiljak, Helen Yarmolinsky, and H. C. Sherman. *Journal of Nutrition*, 30: 343–348, 1945.

WATTS, E. H.—Anesthesia in the Aged. *The Canadian Medical Association Journal*, 53: 20, 1945.

WERMEL, MICHAEL T. and Selma Gelbaum. Work and Retirement in Old Age. *American Journal of Sociology*, 51: 16–21, 1945.

WIEHL, DOROTHY—and Katherine Barry. Medical Evaluation of Nutritional Status: XVI. Essential Nutrients in Diets of High School Students According to Sex and Age and for Different Cultural Groups in New York City. *Milbank Memorial Fund Quarterly*, 23: 353–385, 1945.

WORK—Work and Retirement in Old Age. Michael T. Wermel and Selma Gelbaum. *American Journal of Sociology*, 51: 16–21, 1945.

YARMOLINSKY, HELEN—(See Campbell, H. L., Madeline Udiljak, Helen Yarmolinsky, and H. C. Sherman.)

ZEMAN, F. D.—Subacute Bacterial Endocarditis in the Aged. *American Heart Journal*, 29: 661–684, 1945.